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Railway Mechanical Engineer

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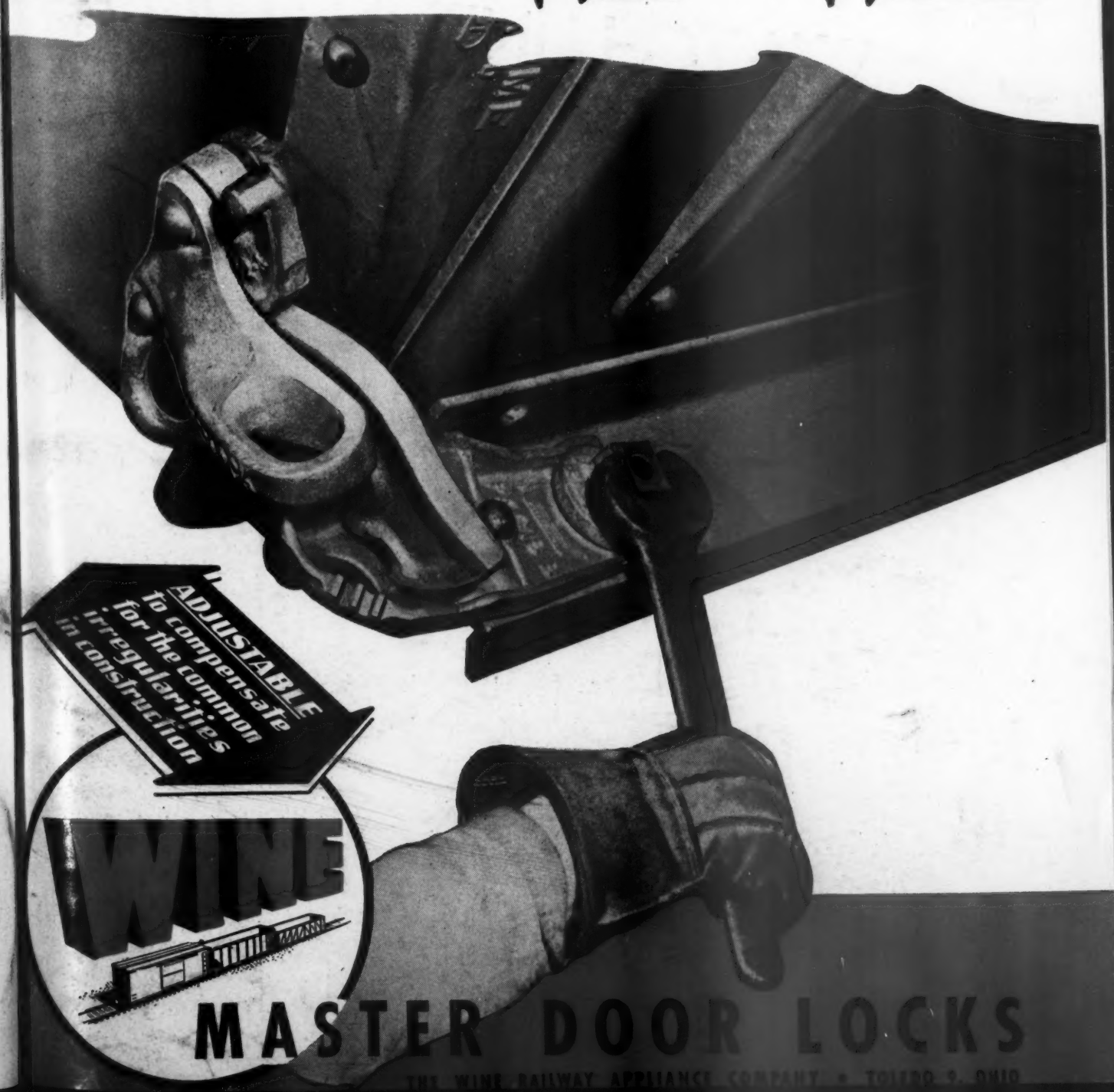

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(Names Registered, U. S. Patent Office)

Founded in 1832 as the American Rail-Road Journal

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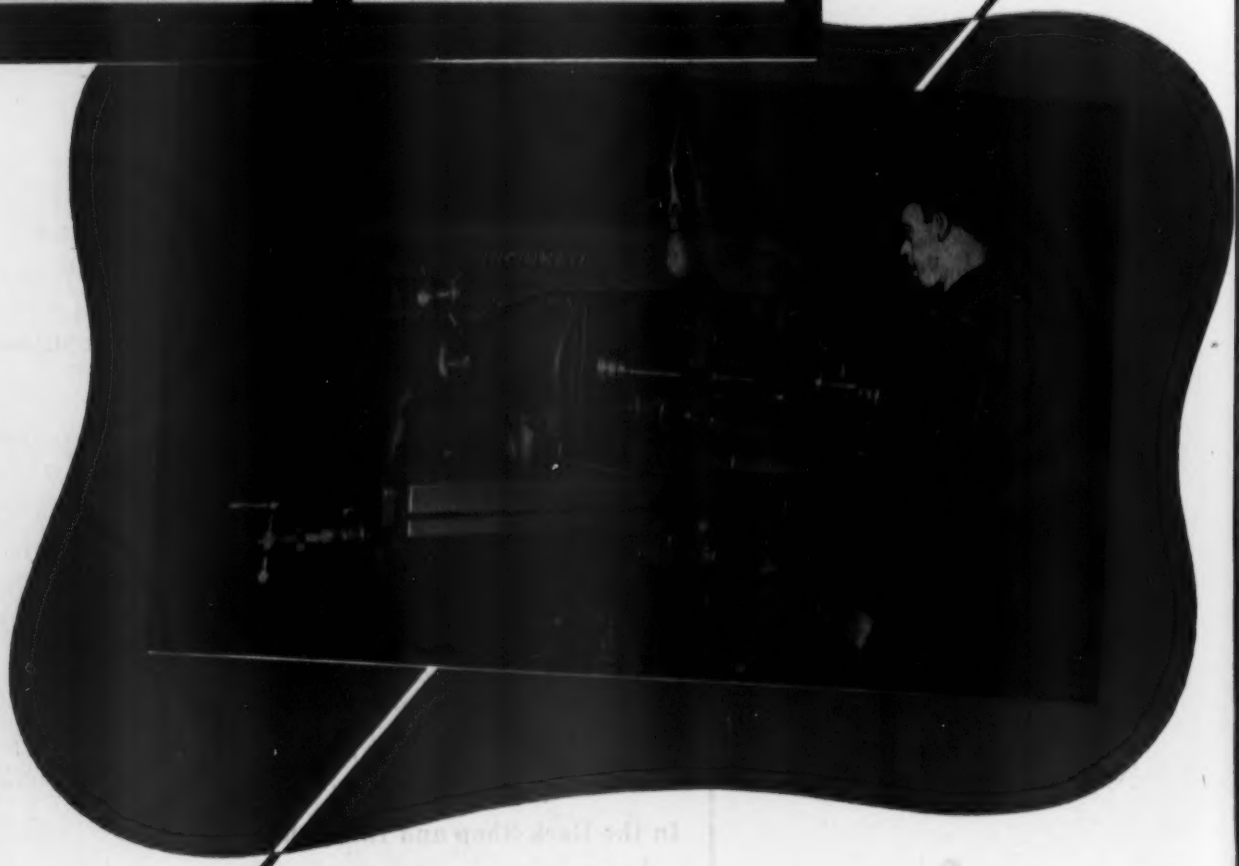

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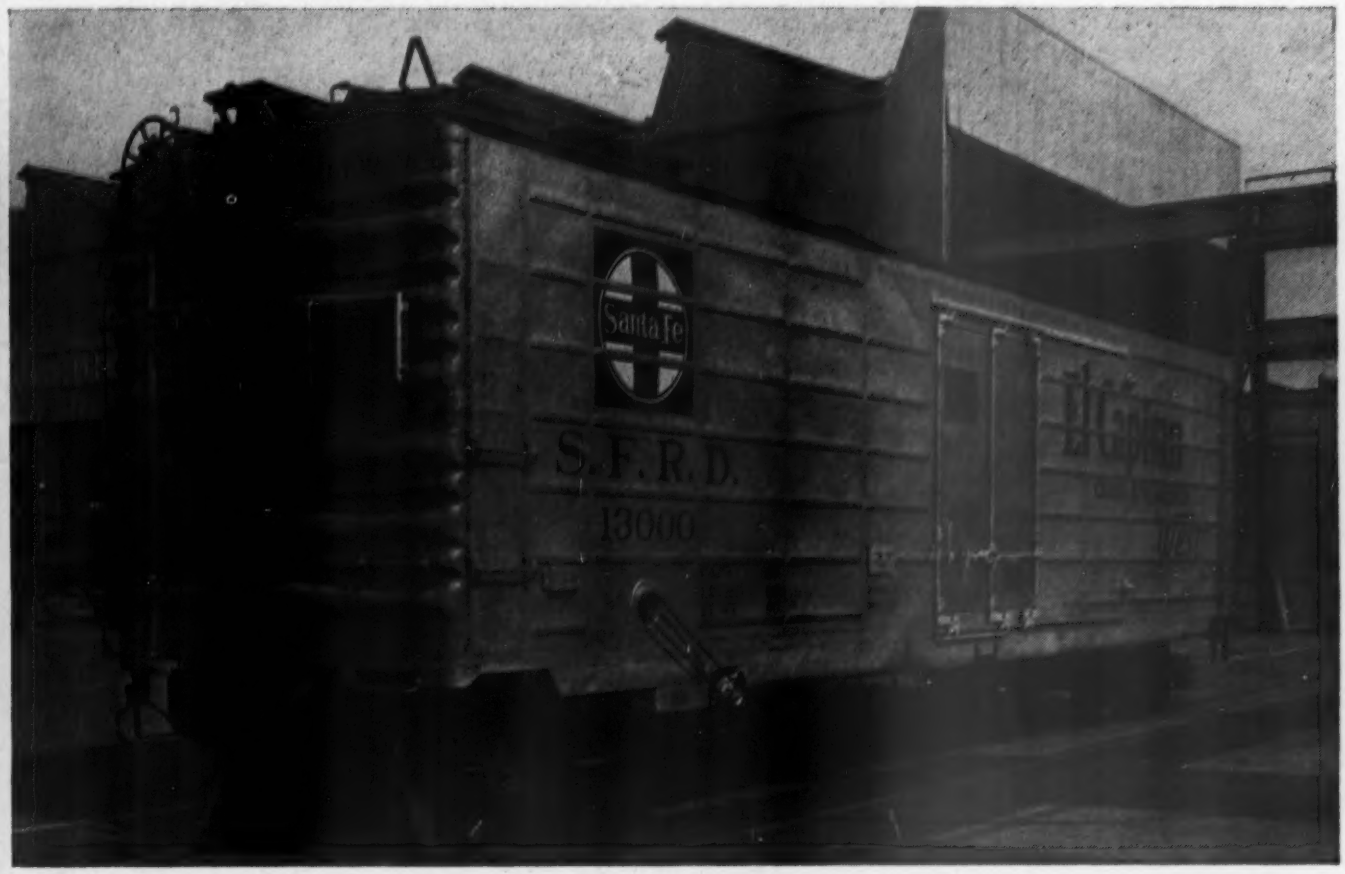


Santa Fe Buys

Stainless Refrigerator Car

Forty-ton general-purpose car has sliding side doors, convertible bunkers, stage icing, side air ducts, and Perco fans

A STAINLESS-steel refrigerator car in which several novel features are incorporated was delivered to the Atchison, Topeka & Santa Fe last fall by the Consolidated Steel Company, Los Angeles, Calif. This is a general-purpose 40-ft., 40-ton car, utilizing water ice as a refrigerant and featured by new convertible bulkheads, 6-ft. sliding doors and a materially improved air-circulating system. The car utilizes essentially welded steel construction, has a light weight of 57,200 lb., load limit of 78,800 lb. and other weights and dimensions as shown in the table.

Reverse forced-air circulation is supplied in this car by means of Preco fans, and, for frozen loads, cool air is circulated along the inside of the insulated walls of the car instead of through the load. A lever over each side door operates louvers along the top of the sides extending for the length of the car between bulkheads, opening or closing the one-inch air ducts inside the walls and doors. When these louvers are closed the ducts form an additional one-inch dead-air-space insulation along the car sides and doors. Patent applications are pending on the form of louvers which are used at the top of the continuous side ducts.

The Consolidated Steel convertible bunkers installed in this car are a lightweight design and take full advantage of forced-air circulation to provide maximum ice surface exposed to the circulating air, rather than ducts

between the wall and an ice basket. They have fewer parts than the conventional bunker, are made of galvanized steel to resist corrosion of water and salt, and afford a simple method for changing from full-bunker to half-bunker icing. They are easily and quickly converted by one man to give maximum lading space when bunker ice is not required and the bulkhead can be moved toward the center of the car and rotated to give access to the ice bunker. The cubic capacity with the bulkheads in is 1,973 cu. ft. and, with the bulkheads out, 2,316 cu. ft.

The Preco fans are driven from the car wheels but, for precooling with the ice bunkers filled, electric motors can be slipped on mounting brackets to give air circulation in a stationary car equal to the circulation at 50 miles an hour. The fans permit elimination of the conventional ice basket and the contact of air and ice is, therefore, direct. Hot-dipped galvanized steel floor racks, made by the Transportation Specialties Company, are installed.

Ice grates in the bunker

The car is designed to take full advantage of the equipment selected and give maximum circulation of cool air for both frozen and non-frozen loads and precooling needs.

The car underframe includes a center sill, made of Grade A steel (60,000 to 72,000 lb. per sq. in. tensile strength), with Yoloy, a weldable high-yield point, low-alloy steel (2 per cent nickel and 1 per cent copper) used for the bolsters. The center sills are reinforced at the ends by welding plate and bar material to eliminate the usual heavy striker castings. Welded construction is used to achieve maximum strength with minimum weight. The Standard Railway Equipment Company's new cushion coupler carrier and positioning device is applied, with Miner Type A-22-XB friction draft gears and Type E, 6¼-in. by 8-in. straight-shank couplers.

Principal Dimensions and Weights of Santa Fe Stainless-Steel Refrigerator Car

Length between coupler pulling faces, ft.-in.	44- 9⅛
Length over striking castings, ft.-in.	42- 3½
Width over side ladders, ft.-in.	9-11¼
Width over side plates, ft.-in.	9- 3⅛
Height, rail to running board top, ft.-in.	13- 8⅛
Inside length, ft.-in.:	
Between end linings	40- 5⅝
Bulkheads out	39-0
Bulkheads in	33- 1⅝
Inside width, ft.-in.	8- 2⅛
Inside height, ft.-in.:	
Floor to ceiling	7-10⅛
Floor racks to ceiling	7- 2⅝
Truck—center distance, ft.-in.	31- 3½
Truck—wheel base, ft.-in.	5- 6
Capacity, cu. ft.:	
Bulkheads in	1,973
Bulkheads out	2,316
Ice-box capacity, cu. ft.:	
Full icing	810
Stage icing	164
Car weights, lb.:	
Body weight	42,900
Truck weight (2)	14,300
Total weight	57,200
Load limit, lb.	78,800

The side frames of the car are structural-type welded trusses with tension diagonals to take most of the stress off the side sheathing. A hat-section, or channel with flanges on each extended leg for the diagonals, gives added rigidity. Both posts and diagonals are of the same Yoloy steel as the bolsters, for maximum strength per pound and increased corrosion resistance.

Car ends are stainless-clad steel, Dreadnaught-type, made by the Standard Railway Equipment Company. The hot-dipped galvanized roof is a product of the same company.

Side sheathing is stainless steel, 18-gage, 18 per cent chrome, 8 per cent nickel, cold rolled. To avoid distortion in welding, horizontal ribs were pressed in the sheets. This permitted welding to the side frames relatively thin sheets, on all four edges, by the Union Melt process, without serious wrinkling of the flat surfaces. The welding was done at the rate of about 60 in. per min.,

The Consolidated Steel sliding door set for sliding open (right), in the toggle position (center), and closed (left)

The Preco bulkhead in place with floor racks raised (left), pulled out and rotated (center), and collapsed (right)

with stainless weld rod. The pressed ribs give added rigidity as well as a distinctive appearance.

The insulation consists of blanket and panel-form Fiberglas and Silvercote paper in the sides, ends and roof. The Fiberglas is 5 in. thick at the sides of the ice bunkers and 3½ in. elsewhere. There is an additional ½-in. board form insulation in the roof. The floor has 4 in. of Hairinsul, plus standard Mulehide asphalt construction with 1¾-in. wooden floor between and $^{25}/_{32}$-in. tongue-and-groove beneath. The walls and ceiling are covered with plywood having the edges sealed against moisture. There are two layers of plywood on the sides, with a one-inch air duct or dead-air space between, depending on the position of the louvers.

Doors of Unique Design

The Consolidated Steel doors are a unique new sliding type which give the same six-foot opening as in a standard box car. Patent applications are pending on this door which uses the well-known toggle principle, permitting great pressure at the side jambs with little manual effort. La Flare type of spring, wood and canvas seals are used. The door construction permits using beveled strips at the vertical edges to lock against the door jambs and resist lateral pressure without interfering with the normal opening and closing.

The sliding door is of two panels hinged at the center. When closed, no part of the fixtures or track extends out as far as existing fixtures on swinging doors. When open, no part extends out from the side of the car as far as swinging doors for smaller openings even when they are hooked to the car side.

Opening and closing operations are simple and require less manual effort than for smaller swinging doors. After the seal and padlock are removed, the end of a bar, or lever, centered in an operating mechanism near the middle of the doors is raised out of the lock and moved outward from the side of the car, rotating horizontally 180 deg. from left to right. The first half of this motion operates the toggles, that is, the two door panels at the central vertical hinge move outward, drawing the door away from the side jambs. The second half of the operating-bar rotation moves the right edge of the right-hand door panel outward so that the panel is parallel to and clear of the side of the car. The end of the operating bar is dropped in a slot on the right panel of the door and the door is ready to slide. Although the two motions are described separately, actually one movement of the handle accomplishes the two operations.

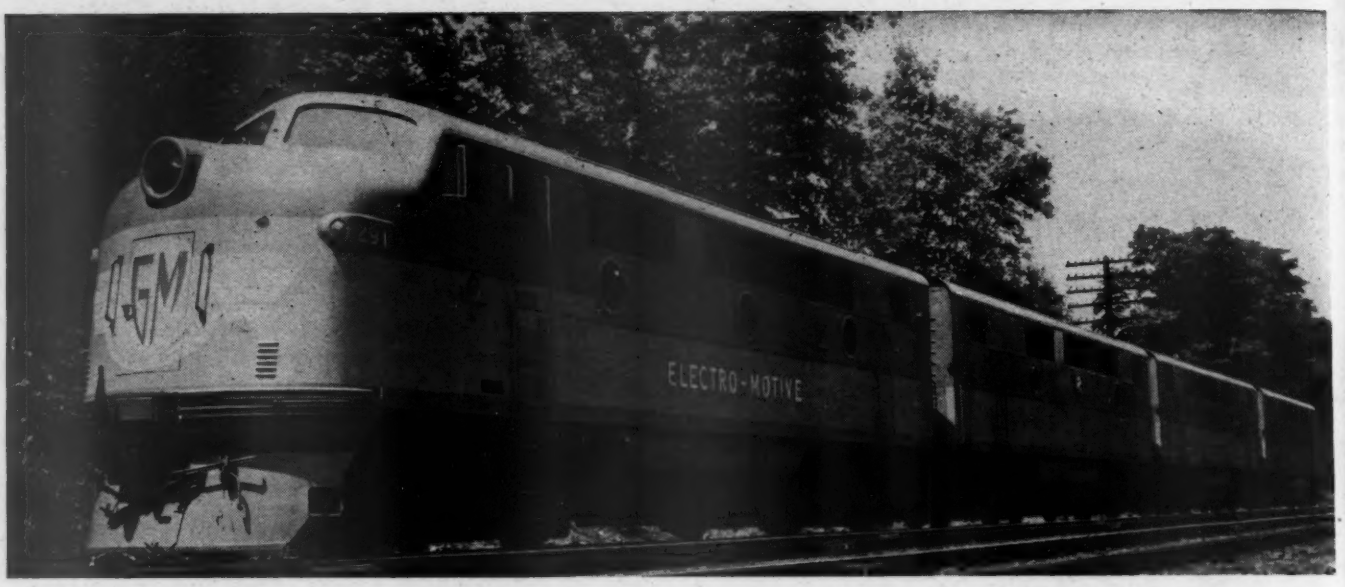
The operator then takes hold of the grab iron at the left of the door and slides the door to the right. The grab iron is free to rotate through a small angle which operates the latch and, through leverage against a striker plate, gives starting impulse to the sliding motion of the door. The left panel will automatically track until it, too, becomes and remains parallel to the side of the car. When the door strikes the buffers the latch automatically locks it until it is manually closed in reverse operation.

The mechanism of the door consists of relatively few parts and is strongly made. At the bottom is a standard box-car track which carries the main load. The upper track on this experimental car is a formed modified

The Consolidated Steel louvers are open and the top thermometers visible

Z-section. The doors are fastened to three vertical rods, to one of which is fastened the operating bar. The rods are connected to the track bearings by horizontal arms at the bottom and top. It is by the rotation of these arms as the rods are turned by the operating lever that the doors are moved in and out of the door opening in the sides of the car. Ball-bearing rollers are packed with grease and triple sealed against moisture and grit.

(*Continued on page 68*)

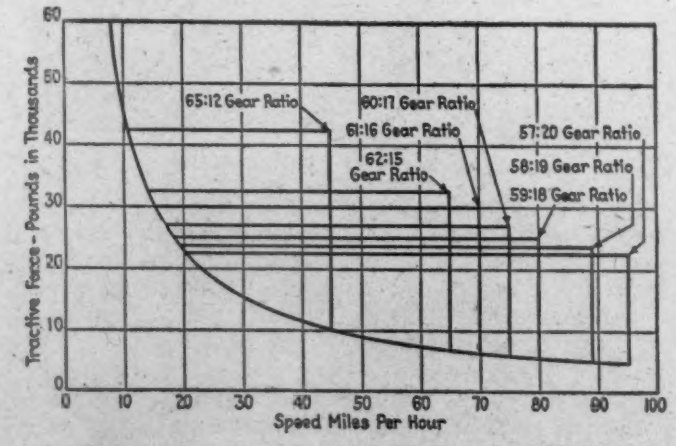


E. M. D.'s All-Purpose Diesel

The Electro-Motive Type F-3 locomotive may be adapted to either freight or passenger service by a change in gear ratio — Each unit develops 1,500 traction horsepower

THE new Electro-Motive Type F-3 Diesel locomotive is a motive power unit designed to meet railroad needs for flexible performance and adaptability to a wide range of services such as heavy-duty freight, heavy-duty fast passenger or mountain-type passenger service with the same locomotive. With four units developing a full 6,000 hp. for traction purposes, this locomotive can be used for speeds up to 100 miles an hour in passenger service, 50 to 65 miles an hour in freight service or any desired intermediate speeds by simply changing the gear ratio.

Another major objective in the locomotive design is provision for simplified maintenance by means of more readily interchangeable parts. The first F-3, placed in service over a year ago, has accumulated more than 110,000 miles under all kinds of operating conditions on twenty-one different railroads throughout the country. While regular inspections are recommended at 3,000-mile periods, the F-3 made over 60,000 miles in one tight schedule of demonstrations before going to a shop, even for inspection.



Speed-tractive-force curve for the E.-M. Type F-3 1,500-hp. unit

The F-3 locomotive comprises a single unit of 1,500 hp., or any combination up to 6,000 hp. with four units, the latter generally consisting of a lead unit at either end and two booster units in between, so the locomotive may be operated in either direction without turning. F-3 units may be used interchangeably with previous Electro-Motive F-2 *A* and *B* units when necessary. The company will continue to build improved streamliner Diesel locomotives for ultra high-speed operation in lightweight trains, as well as 600- and 1,000-hp. Diesel locomotive switchers.

Principal Improvements

Among other improvements in the Electro-Motive Type F-3 Diesel locomotive, the underframe has been redesigned to provide equal overhang and greater length between truck centers. An economical rearrangement of equipment and small increase in car body length not only give greater accessibility for adjustment and maintenance, but more space for steam-heating generators and water tanks.

The Diesel engine, generator, controls and traction motors are a balanced combination, designed to develop full drawbar horsepower over the full speed range of the locomotive. In the F-3 locomotive a new and larger main generator not only permits utilization of more of

the inherent horsepower in the E. M. D. 16-567 engine, but produces both a.c. and d.c. current in the same machine, enough a.c. for the auxiliaries and enough d.c. to develop 1,500 propulsion horsepower over the full speed range. This generator is unusually compact. It is accessible for maintenance and is designed for longer brush life.

The a.c. drive for auxiliary equipment eliminates V-belts and extension shafts and makes possible such innovations as a new engine-cooling system with four fans. By means of an ingenious electrical hook-up, the fans are operated in any required number to meet all degrees of cooling requirements and in varying combinations to equalize wear on the four units. The control of air volume is fully automatic, the number of fans in service and shutter openings being determined by thermostats effected by engine temperature. The a.c. drive also permits more advantageous location of traction-motor cooling fans and blowers; exhaust of hot air upward over the locomotive center, which eliminates blow-back to trailing units; use of inherently reliable a.c. motors without brushes or commutators.

Weight and Dimensions of the Electro-Motive F-3 6,000-Hp. Road Diesel

Horsepower	6,000
Weight, A or B unit, in working order, lb.	230,000
Two Trucks, lb.	75,600
Length over couplers, ft.-in.:	
A unit	50-8
B unit	50-0
Axle loading, lb.	57,500
Maximum speed with 57:20 traction-motor gear ratio, m.p.h.	98
Continuous rating of each 1,500-hp. unit, lb., at 20.5 m.p.h.	22,500
Engine:	
Type	V-type, two-cycle
Horsepower	1,500
Cylinders, in.	8 x 10
Crankshaft speed, r.p.m.	800
Steam generator capacity, lb. per hr.:	
Standby	300
Train heating	1,600
Fuel carrying capacity, gal.	1,200
Cooling water, capacity, gal.	230
Lubricating oil capacity, gal.	200
Sand, cu. ft.	16

The rearrangement of equipment on the basis of extensive E. M. D. experience simplifies the engine-room layout and gives more space for inspection and maintenance work. For example, electrical and plumbing stacks are sub-assemblies, accessible from all four sides and easily renewable when necessary. Dynamic brake grids and associated machinery are all in one roof hatch which may be easily inspected and removed as a unit.

A new transition meter with short-time overload ratings has been greatly simplified, making it easier for the engineman to read and understand. It also gives a definite check on whether or not the train load is excessive for grade conditions.

Steam generators, with 300 lb. per hr. capacity for standby heating or 1,600 lb. per hr. for train heating, are of the Vapor improved type.

The new engine governor gives better synchronization of speed and power output and incorporates an electro-pneumatic throttle control and regulator pilot valve, with provision for automatic shut-down when the lube-oil pressure runs low.

The basic air-brake schedule can for the first time be used in conjunction with automatic train control, electro-pneumatic portion of the air brake schedule and dead-man control. This air brake schedule on the F-3 is designed to function satisfactorily with that on earlier E. M. D. Diesel locomotive units.

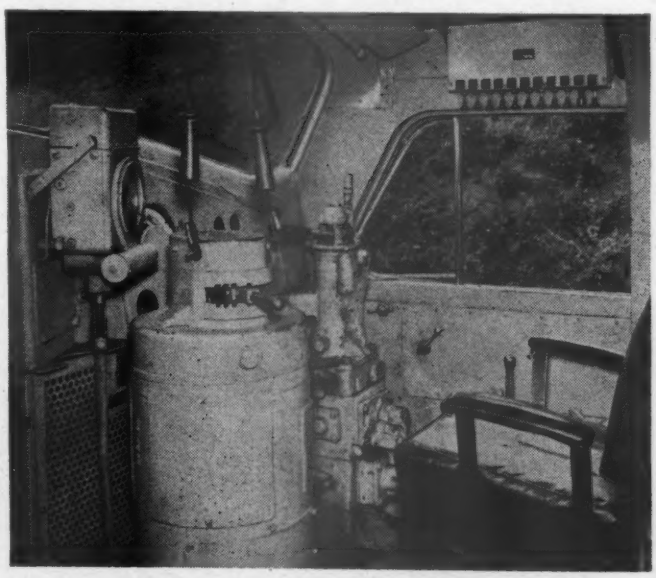
The four-wheel truck design enables the locomotive to negotiate any curves which a freight car will take, and the outside swing-hanger design and balance between coil and elliptic springs assures unusual stability at high speeds. This truck, as well as all other details of the locomotive and power plant, is designed for high reliability and availability, with attendant low operating and maintenance costs.

Locomotive Construction

Lead and booster units of the F-3 locomotive have identical power plants and the same general arrangements except for cab and control equipment in the former and a 1,200-gal. boiler water tank in the latter. One of the drawings, for example, shows the location and arrangements of the 1,500-hp. Diesel engine, generator, necessary auxiliaries, four-wheel power trucks, etc., in the lead unit which is 50 ft. 8 in. long between coupler pulling faces, 30 ft. between bolster centers, 10 ft. 7 in. wide between handholds and 15 ft. high over the horns. Each truck, with a 9-ft. wheel base, is equipped with two motors, gear-connected to the two pairs of 40-in. driving wheels.

The two trucks weigh 75,600 lb. and the total loaded weight on rails of the lead unit is 230,000 lb. The fuel-carrying capacity is 1,200 gal., sand, 16 cu. ft.; cooling water, 230 gal., and lubricating oil, 200 gal. When a 300-lb. steam generator is supplied for standby service only, 300 gal. of water capacity is required. When used in passenger service, 1,600-lb. steam generators may be applied in both lead and booster units. Dynamic brakes are optional equipment. The locomotive is designed to operate safely on a 21-deg. curve with 2¼ in. free lateral motion in the truck bolster and ⅜ in. in the Hyatt journal boxes.

The control cab is located ahead of and above the locomotive floor, giving an unobstructed view to the operating crew. The cab is insulated where possible with 2 in. of insulation, fire and moisture proof, and equipped with two upholstered swivel-type seats having arm and back rests. The inside finish consists of ceiling-lined acoustical treatment, while the cab floor is wood within steel framing, linoleum covered.



The engineman's control station and equipment in the cab

A centering device is used at each end of the locomotive, preventing excessive offset with multiple-unit operation. National Malleable type M-380 rubber draft gear are installed at the front and rear, with special E. M. D. yokes having low overhang.

The pilots are designed to withstand substantial shock, braced firmly laterally and longitudinally. An anti-climber device is installed at the intersection of the pilot and underframe.

Improved riding qualities and greater stability are obtained by a new E. M. D. method of load suspension in the trucks; The Commonwealth cast-steel truck frame is supported on each of the four journal boxes by twin-group coil springs. Full elliptic bolster springs rest on each end of the spring plank which, in turn, is carried by swing hangers pivoted from outside the truck frame. Each of the four motors is supported by the driving axle to which it is geared, and a special suspension on the truck transom gives a flexible support, dampening out the torque shocks of the motor.

The 16-cylinder two-cycle Diesel engine

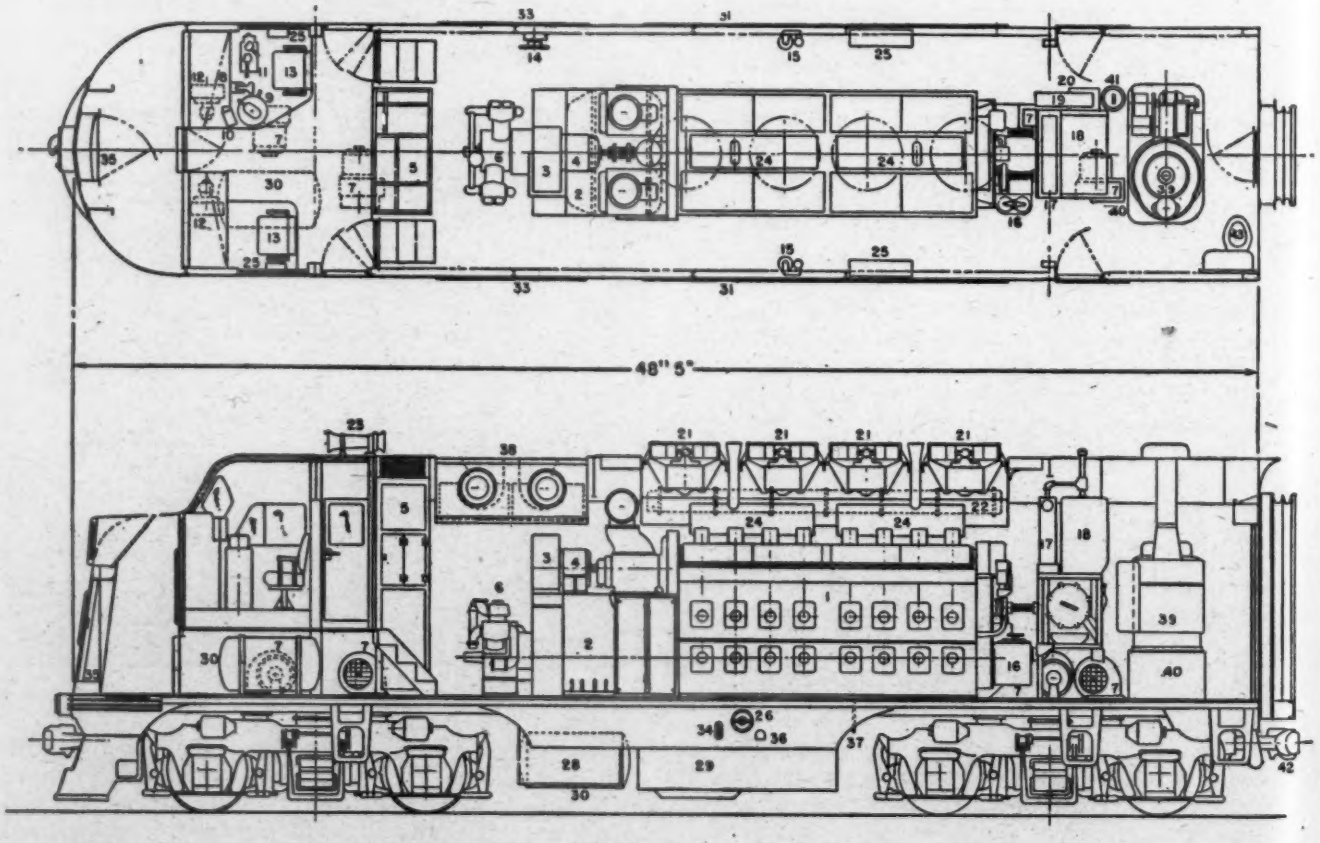
Oversize E-12 axles with oversize wheel and gear seats are installed. The Hyatt roller bearings, on 6½-in. journals of E. M. D. design, are housed in journal boxes which take lateral thrust directly, through a cushioning arrangement.

Truck center plates are designed with wear plates, dust guard, and lubricating arrangement. Friction type side bearings are installed. Body and truck interlocks on each side of the center plate serve as an anti-sluicing device in case of derailment.

Clasp brake rigging is installed on each wheel, operated by individual brake cylinders. All pins and bushings are hardened and ground, large size, and all holes in the brake rigging are bushed. The hand brake is connected to one brake-cylinder lever only. All trucks have levers for hand-brake connection, making trucks interchangeable.

Power Plant

Power is generated in each locomotive unit by a G. M. 1,500-hp., 16-cylinder, 2-cycle, V-type Diesel engine (E. M. D. Model 16-567 B), with 8-in. bore, 10-in. stroke and 800 r.p.m. engine speed. This Diesel engine is



Lead Unit

1—Engine E. M. D. Model 16-567B
2—Main generator and alternator
3—Generator blower
4—Auxiliary generator
5—Control cabinet
6—Air compressor
7—Traction-motor blower
8—Instrument board
9—Control stand
10—Speedometer recorder
11—Air-brake valve
12—Cab heater
13—Seat
14—Hand brake
15—Fuel-tank vent with flame arrestor
16—Lubricating-oil filler
17—Lubricating-oil cooler
18—Engine-water tank
19—Engine control and instrument panel
20—Load regulator
21—34-in. fan and motor
22—Radiator
23—Horn
24—Exhaust manifold
25—Sand box
26—Fuel filler
27—Headlight (fixed beam)
28—Batteries
29—Fuel tank (1,200 gal.)
30—Main air reservoir
31—Air intake and shutters
32—Boiler-water filler*
33—Air intake for grids and engine room
34—Fuel-tank gauge
35—Door, Plain
36—Emergency fuel cut-off
37—Engine-water filler
38—Dynamic brake grids and blowers*
39—Boiler*
40—Boiler-water tank (200 gal.)*
41—Boiler-water softener*
42—Coupler between units**
43—Toilet

* Modifications.
** Options.

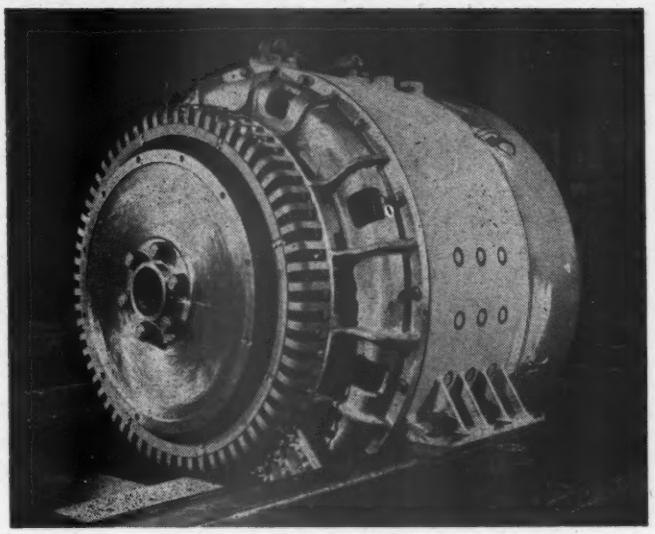
direct-connected to a 600-volt main generator and 149-volt, 3-phase, 16-pole alternator, built integral with the main generator and supplying a.c. power to induction motors which drive the engine-cooling fans and traction-motor blowers. A 10-kw. auxiliary generator with an automatic voltage regulator furnishes current for control circuits, lighting and battery charging.

A load regulator automatically maintains constant horsepower output, corresponding to each throttle position, over the entire range of locomotive speeds. The engine is started by motoring the main generator through the use of special starting fields energized by the locomotive storage battery.

Engine cooling water is circulated by two direct-driven centrifugal water pumps on the engine, tube-finned type radiators and four a.c. motor-driven cooling fans located in the hatch above the engine.

Gear-type main-bearing and piston cooling pumps supply oil for lubricating all bearings, rods, cams, rocker arms and pistons, while the scavenging pump with a capacity in excess of the combined total of the two pressure pumps filters and cools the oil.

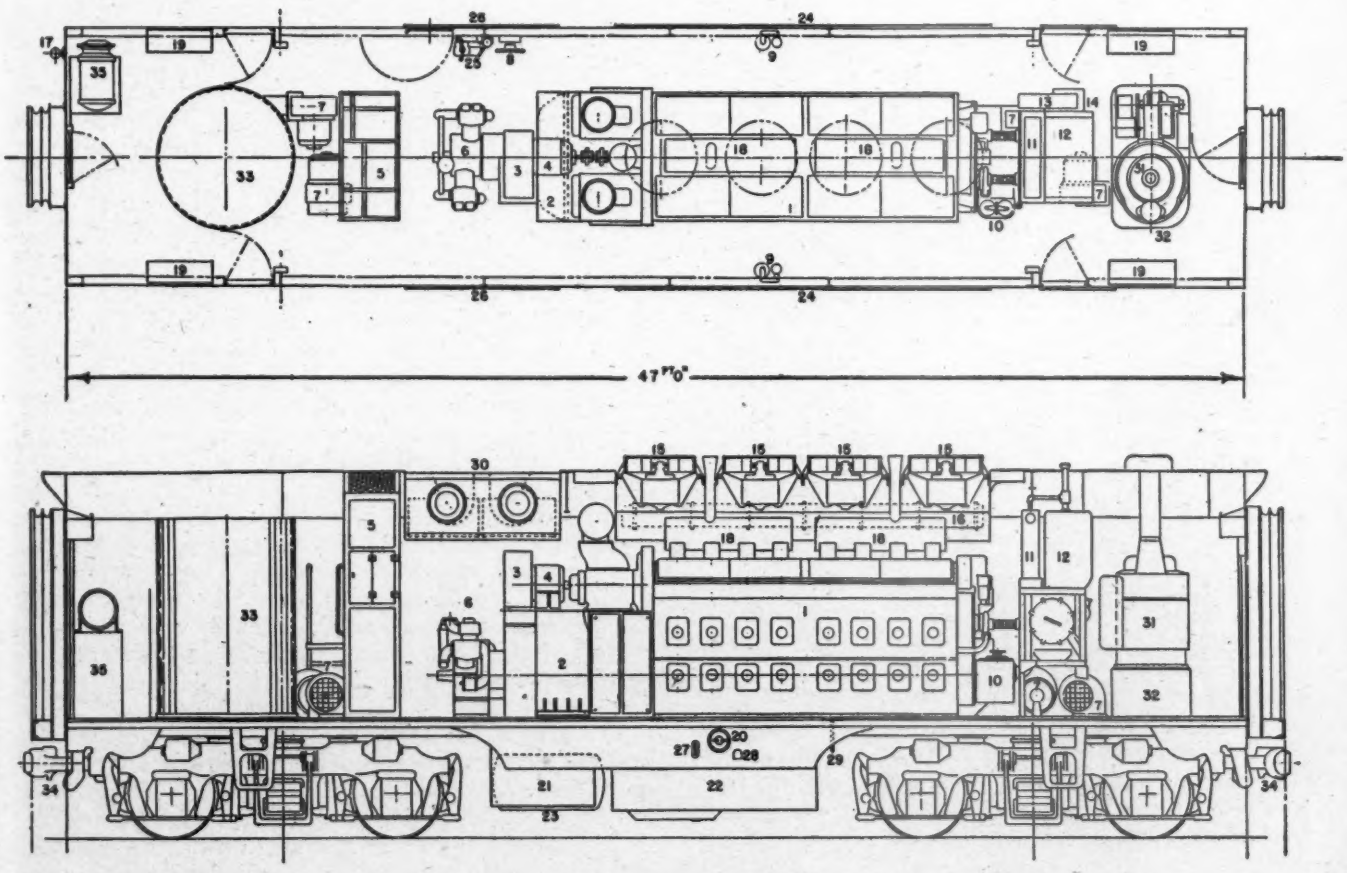
Engine fuel is supplied from a return-flow, single d.c. motor-driven gear pump, protected by a suction filter in addition to discharge filters to insure clean fuel for the engine. An assembly of sight glasses and relief valves offers visual indication of any system trouble plus protection against excessive pressures. The engine exhaust comprises dual fabricated chambers, each with independent exhaust.



The combination a. c. and d. c. generator

The storage battery is an Exide 32-cell, 64-volt, 426 amp.-hr. battery, located in two cabinets, one on each side

(*Continued on page 68*)



Booster Unit

1—Engine E. M. D. Model 16-567B
2—Main generator and alternator
3—Generator blower
4—Auxiliary generator
5—Control cabinet
6—Air compressor
7—Traction-motor blower
8—Hand brake
9—Fuel-tank vent with flame arrestor
10—Lubricating-oil filler
11—Lubricating-oil cooler
12—Engine-water tank
13—Engine control and instrument panel
14—Load regulator
15—34-in. fan and motor
16—Radiator
17—Horn*
18—Exhaust manifold
19—Sand box
20—Fuel filler
21—Batteries
22—Fuel tank (1,200 gal.)
23—Main air reservoir
24—Air intake and shutters
25—Hostler control*
26—Air intake for grids and engineroom
27—Fuel-tank gauge
28—Emergency fuel cutoff
29—Engine water filler
30—Dynamic brake grids and blowers*
31—Boiler (1,600 lb. capacity)*
32—Boiler water tank (200 gal.)*
33—Boiler water tank (1,200 gal.)*
34—Couplers between units**
35—Air-brake equipment

* Modifications.
** Options.

Air-Brake Control Devices*

By C. D. Stewart†

A description of supplementary equipment to improve train operation—Weight-saving material used for the first time in the construction of freight brakes

DEALING first with new devices for modern passenger cars we find a list of apparatus that covers a wide range of requirements, including several forms of control that supplement the conventional air brake to give (1) faster response; (2) more flexible control; (3) the practical use of higher braking forces; ad (4) greatly reduced likelihood of sliding wheels.

In anticipation of these supplementary controls we designed the D-22 Control Valve about ten years ago so that although its basic functioning is similar to the well-known universal control valve, it differs from it in one important respect. Instead of the air flowing directly by way of the control or triple valve to the brake cylinders, a pneumatic relay valve is interposed that under certain conditions during a brake application, isolates the triple valve and directly controls the flow of air from and to the brake cylinders. This arrangement permits independent control of the brake cylinder pressures whereby the braking force initiated by the engineman may be altered locally to meet changing conditions during the stopping of the train.

C. D. Stewart

Two Systems of Control

Before discussing these local independent controls, however, it will be well to say a word on the two distinctly different systems of bringing air under pressure to the relay valve. The first involves the use of conventional triple or control valves wherein a brake pipe reduction initiated by the locomotive brake valve causes the first triple valve in the train to move to application position and it in addition to developing pressure to the relay valve, transmits the brake application through the train brake pipe by the usual means of local brake pipe venting.

The second system involves the use of the more recently developed electrical control that is installed in parallel to the conventional pneumatic system. No brake pipe reduction is involved for service braking but instead an electric circuit running through the train is energized by the locomotive brake valve to cause the development of pressure on the relay valves through the medium of magnet-operated control valves. The brake action is simultaneous on every car in the train and effects material savings in time in two ways. First, the time required for pneumatic transmission is eliminated; and second, because the response is substantially instantaneous and simultaneous, the engineer can judge the requirements much more accurately and thereby regulate his varying permissible speeds more closely. Very material savings in running time are thereby effected. From the standpoint of the customers' comfort, smoother train operation is realized.

The brake cylinder pressure on each car equipped with a relay valve will correspond with that at the face of the relay valve until a local condition makes it desirable to alter it. Let us assume several such conditions.

High-Speed Operation

First, there is the situation associated with high-speed operation. It is well known that the friction of the brake shoes is low when the wheel speed is high. Heretofore it has been the practice to limit for emergency braking the maximum force that could be tolerated for the low speed portion of the stop to avoid excessive wheel sliding. Because this force was lower than could be used at the higher speeds and still avoid wheel sliding the stopping distances were of necessity longer than they otherwise needed to be. From this it is apparent that to provide the permissible braking force for the varying train speed, a variable brake shoe force controllable by the change in train speed is required. To meet this requirement the speed governor control was developed, with which the control of the brake shoe force may be varied in substantial conformity with the variation in the brake shoe friction.

This control is readily incorporated in the relay valve whereby the brake cylinder pressure is lowered as the train speed decreases. This control that is a supplement to the conventional brake equipment consists of an electric speed-recording governor mounted on one axle of each car, a relay cabinet containing several electric relays, each one of which is designed to respond to different and particular car speeds, and a pneumatic differential adjunct to the relay valve in which a different pressure value is associated with a particular speed-sensitive electric relay. Basically this provides step control of pressures but by properly tuned exhaust chokes a substantially continuous reduction in brake cylinder pressure is obtained.

Specifically the basic braking ratio values for emergency operation are 250 percent from maximum train

* This article is adapted from a paper presented at the annual meeting of the Railway Fuel and Traveling Engineers' Association on September 5.
† Vice-president, Westinghouse Air Brake Company.

speed to 65 m. p. h., followed by a gradual reduction to 200 per cent between 65 and 40 m. p. h., followed by a further gradual reduction to 150 per cent between 40 and 20 m. p. h., and a still further gradual reduction to 100 per cent from 20 to 0 m. p. h. This compares with 150 per cent maximum braking ratio held constant throughout the stop for non-speed governor control equipment. Thus it will be seen that braking forces can be employed for high speeds very much in excess of what is practical without automatic means for regulation. Of equal importance, lower braking forces for 20 m. p. h. and under can be used without the sacrifice of over-all stopping distance and with material benefit from the increased comfort to the passengers and the absence of wheel sliding.

Buyers of new cars whose operating conditions at the time do not justify the installation of speed governor control may have the differential adjustment feature of the relay valve installed and set for the 150 percent braking ratio value. At that time the brake rigging is made suitable for the ultimate use of the 250 percent braking ratio and when speed govenor control is required it can be added without the necessity of discarding any of the original equipment. This practice has been followed in the building of a number of cars now in service.

Low Rail Adhesion

A second situation that makes it desirable to have the ability to vary locally the brake cylinder pressure is low rail adhesion that may cause wheel sliding. As we have said previously the speed governor control provides for higher braking forces than can otherwise be used and with actually lower possibility of wheel sliding. However, there are occasional instances of subnormal rail adhesion when relatively low braking force can cause the wheels to slide. For such temporary situations the wheel slide protection was developed.

This device, termed a Decelostat, functions to reduce momentarily the braking forces on the wheels that are slipping and thereby permits their resuming train speed. The activating mechanism consists of an inertia device mounted on one journal box of each axle and rotated at axle speed by a suitable driving means, and a brake-cylinder pressure-lowering device associated with each truck. The inertia device is non-responsive to the normal rates of wheel deceleration developed during a stop, but it is immediately responsive to a deceleration rate in excess of normal such as occurs when a wheel is slipping into a slide. The pressure control device is thereby caused to reduce promptly the brake cylinder pressure for a short interval of time required to permit the wheel to resume rotation at rail speed. The initial brake cylinder pressure is then immediately restored.

One such functioning is usually sufficient during a stop because subnormal rail adhesion is generally limited to highway crossings or similar restricted areas. If, however, there are situations wherein low adhesion is more extensive and perhaps more common, such as for example at water pans or in certain sections of the country where local seasonable conditions are adverse, then it is desirable to provide means for improving the rail adhesion on the first wheel slip indication. For such situations automatic sanding is readily associated with the wheel slip detector to sand the rail during the stop following this first wheel slip indication. This method of controlling, automatically, the sand has several marked advantages. It limits the use of sand to the occasions when it is actually needed, thereby conserving sand, and it applies the sand at exactly the right time and place.

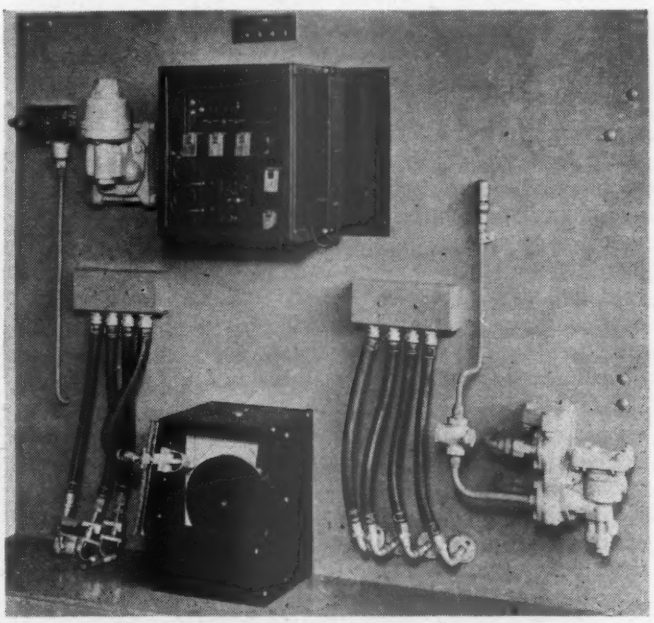
Signal Discharge Muffled

An additional improvement that is of a very minor character but important to passenger comfort is the muffling of the car discharge valve of the pneumatic signal system. We have listened to the noisy blast of the signal system for so many years that we have come to taking it for granted but today's passengers are noise conscious and the present device has come in for its share of criticism. A new car-discharge valve has its exhaust sheathed in a muffler that produces a whisper with which the most exacting customer would have difficulty finding fault.

Finally the use of this same pneumatic signal system has been pressed into the additional service of warning the engineman of an impending hot car journal.

Hot Journal Detection

Delays and accidents due to hot journals have stimulated thinking of a means for warning the train crew that a car or locomotive journal is over heating. Many forms of detectors have been developed and tried over the years. Some of these give off a characteristic odor; others emit smoke when the journal reaches a predetermined temperature. Still others employ a thermometer



The demonstration rack for the hot-journal detector showing the principal parts of the device

type of gas-filled bulb that on expansion causes the flashing or sounding of an alarm.

Little scientific study of this subject has been made until recently and one of the interesting discoveries is that the critical temperature for a journal bearing varies with the change in ambient temperature. It is obvious that a bomb or thermal type of temperature detector will function at its designed operating temperature regardless of what the surrounding temperature may be and, therefore, it is incapable of detecting the critical bearing temperature except for one condition of the surrounding atmosphere. To have a temperature-checking device accommodate itself to varying ambient temperatures appears at first to be most difficult of accomplishment since it appears to involve a complex compensating means.

This was true until an exceedingly simple means was discovered in an adaptation of the well-known wheatstone bridge instrument which is normally in electric

balance and reacts to an electrical unbalance in its circuit. As adapted to detect dangerous temperatures in a car bearing, certain resistance legs of the bridge circuit are installed in the car journals, one resistance unit to a journal, and the others are placed in a suitable electrical cabinet. Obviously as the atmosphere surrounding the cabinet varies with the seasons, the balancing requirement of the bridge circuit is automatically varied. This situation corrects the journal temperature device so that it responds only when the danger from overheating is imminent. Thus no false warnings are sounded nor does the device fail to notify under any variation in weather temperature.

The electrical device having detected a journal bearing approaching a dangerous temperature, it can actuate one or more of several alarm devices. A light or a bell may be energized within the car that is developing the hot journal or by way of the air signal system the engineman may be warned. This latter scheme appears to be the most practical from all points of view.

Giving the Warning

To initiate a pneumatic signal from the hot box detector the electric circuit includes an electro-pneumatic valve which is connected into the pneumatic signal system. Normally the magnet of this valve is energized and thereby holds closed an atmospheric vent from the signal line. A journal bearing approaching dangerous temperature causes an unbalancing of the wheatstone bridge circuit whereupon an electric relay is caused to open the electric circuit that normally connects the magnet valve with the car battery. The exhaust valve is thereby permitted to open, the signal line pressure is lowered and the signal whistle in the engineer's cab is sounded.

Some have expressed the wish to have a whistle code produced by the defective bearing. This can and has been done but it is much simpler and in our judgment equally satisfactory to have this hot-journal detector produce one long continuous blast of the locomotive signal whistle. This can be done in a very simple manner. The magnet valve on being de-energized by the hot-journal detector circuit opens the signal line to atmosphere. The resultant continuous discharge of air being at a greater rate than the charging valve on the locomotive replenishes it, permits the signal line pressure to fall steadily. This fall in pressure causes the signal whistle in the engineman's cab to blow until the pressure in the signal pipe is almost depleted, which is accomplished in one to five minutes depending on the length of the train.

If a longer continuous signal is found to be desirable the blast can be extended through the addition of a simple transfer valve installed between the locomotive main reservoir and the signal whistle. The transfer valve is normally held inoperative by the air signal line pressure but when this is reduced to a predetermined minimum of say 10 lb. the relay functions to isolate the almost depleted signal line from the signal whistle and to connect the main reservoir supply to it. Thus the signal can be made to blow indefinitely.

An additional indication can be given to the engineman by installing an air gage in the signal line. Under normal signal-line functioning the gage hand will fluctuate a relatively small amount but when the hot box detector functions it will fall to zero. This air gage as well as the continuous blast of the whistle will also give warning of the failure of the signal line such as the uncoupling or bursting of the hose lines between the cars. The wheatstone bridge detecting circuit also has a very unique means of signaling an open electrical circuit. Thus it will be seen that the device for detecting journal box trouble also signals any trouble that may have occurred to it as well, so that it is its own checking device.

Locomotive Controls

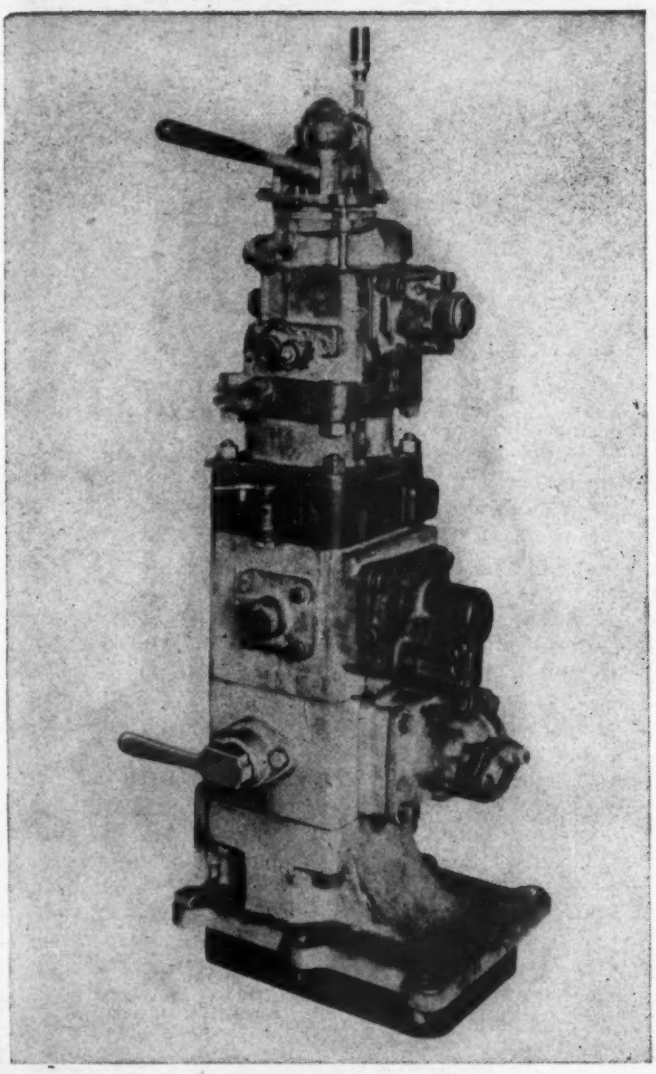
Turning now to the locomotive equipment we find it has undergone as diverse changes as have the passenger cars. The new No. 24 type of brake valve is in many respects the same as its predecessor—the No. 8. It differs from it and all other predecessors in that it is built like a sectional bookcase. There are five basic sections in the pedestal and there are several types of three of these sections. Which type is selected for a particular section is dependent upon the overall functional requirements.

Assuming the locomotive is intended for conventional freight service, then the top or brake-valve handle bonnet section is of the simplest form and corresponds in most respects to the top portion of the No. 8 ET. If, on the other hand, the locomotive is intended for high speed passenger service with electro-pneumatic as well as pneumatic control, the brake valve top will be suitable for operating either control by the same brake valve handle. The selection of the control is made by declutching one type of brake-applying means and engaging the other, both of which are installed within this brake valve top. There are five brake-valve top sections to choose from and any one of these may be applied to the remaining sections of the pedestal at any time. Thus unforeseen changes in operating conditions can readily be provided for at any time with minimum change and expense.

The second section is the same type for all forms of brake valve pedestals.

Brake Valve Portion (Rigid Handle)
Brake Valve Portion
Brake Valve Portion For Pneumatic Straight Air
Rotary Valve and Seat (Same for all)
Application Portion (Emergency)
Application Portion (Service)
Filling Piece Portion (Same for all)
Pipe Bracket Portion

The five basic sections of the pedestal in the new No. 24 type brake valve



The Type DSA-24 Brake Valve

The third section is at present in three types ranging from a simple filler block that carries the numerous air passages through it, to a complex casting containing an automatic brake application mechanism. The purpose of this application device is to produce a service application of the brakes without any action on the part of the engineman, in the event of either a train control reaction or the engineman becoming incapacitated. A third choice of this section contains a simpler valve device that produces emergency application of the brakes under similar circumstances.

The other sections are functionally the same for all pedestal combinations although they differ slightly in construction for Diesel and steam locomotives.

In connection with passenger car equipment we discussed the use of 250 per cent braking ratio. It is equally desirable of course to brake the locomotive as near to this value as it is practical. It is not quite as simple to do, however, because the variation in weight of the passenger car due to load is very small whereas the variation in weight of a locomotive tender is not only large but it changes continuously due to the consumption of fuel and water. To provide a substantially constant braking ratio on the tender a variable load mechanism is added to the conventional locomotive equipment. This device in response to the varying weight of the water in the tender, continuously adjusts the pneumatic variable-load valve which changes the braking force and thus produces a substantially constant braking ratio. To conserve space on the tender which usually is at a premium, we have also taken advantage of the availability of the main reservoir pressure that is at least 25 lb. higher than brake pipe pressure and with this is produced the necessary braking forces with smaller brake cylinders. A differential relay valve that is the reverse of the one designed for the speed governor control steps up the conventional brake cylinder pressures. Thus the diameter of the brake cylinder may be reduced by as much as 25 per cent.

The wheel slip control is, of course, equally applicable to locomotive use. For avoidance of wheel sliding during braking it functions the same as on the cars. It has one additional application, however, for steam locomotives and esepecially the duplex type where slipping appears at times to be more prevalent and the slipping of the front set of drivers is more difficult for the engineman to detect. The wheel slip device is in successful operation on a number of roads performing one or two functions. When either set of drivers slips in acceleration, the inertia device functions just as it does during rapid deceleration and it can notify the engineer by light or whistle of this event or it can initiate the shutting off of steam to the slipping wheels. To this likewise may be added the automatic control of the flow of sand for the purpose of increasing the rail adhesion. A new form of traction sanders has been developed for association with the wheel slip control that is economical in the use of air and sand and highly resistant to clogging.

Pneumatic Throttle Devices

Another group of devices that are not in any way related to air brakes but that employ pneumatic devices comparable to some of those in air brake apparatus are throttle operating controls. These vary in form for the various types of locomotives but are alike in basic principles of operation. The system comprises a pneumatic throttle valve which is substituted for the conventional throttle lever and a pneumatic throttle operating cylinder. Both are self lapping in principle which means that the position of the throttle-valve handle determines the degree of throttle opening. For the steam-turbine locomotive where separate forward and reverse turbines are used, and the reverse turbine is disengaged when the locomotive is moving forward, a mechanical pneumatic interlock is employed whereby the locomotive cannot be reversed while it is moving forward. Simpler forms are used for the conventional steam locomotive and still other forms for Diesel road and switcher locomotives.

Freight Brake Equipment

For the modern light-weight car now receiving much attention the variable-load brake has been designed. It automatically alters the braking forces in response to a variation in the car loading. This equipment differs from the locomotive tender variable-load equipment in two respects. First, since the load varies only at the car's destination point, the weighing device is inert except during the first interval of charging the equipment; second, the deflection of the car springs is employed as an indication of the loading of the car.

The variable load brake also differs from the freight car empty-and-load brake in that is provides for a wide range of load conditions in the place of the two conditions provided for in the empty-and-load brake. This is of particular benefit; in fact, we consider it essential, for those types of cars that have a very wide range of full-load weights such as the box and gondola. There are several reasons for this. When the empty-and-load

brake was designed, light-weight cars were not in existence but the lading of the cars requiring this form of brake was unusually heavy; furthermore, the cars were always either empty or filled with a consistently heavy load. In some cases, too, the grades were heavier than average so that a very effective brake was required for the loaded cars and at the same time the braking forces for the empty car had to be held within a practical minimum limit.

As a result of all these considerations there was no need to make a registering mechanism capable of registering through small spring deflections. This form of brake is not suitable for box or gondola cars that frequently have relatively light full loads because some particular intermediate full or partial load value would cause the load brake to cut in and the maximum braking forces would be greatly in excess of what is required and desirable.

The load compensating brake, on the other hand, is entirely satisfactory functionally for cars that formerly required the empty and load brake and the benefits to be gained by extending its use on all types of cars are those that accrue to both the user and the manufacturer from one form in place of two or more forms of apparatus.

The load compensating brake is simpler in certain important respects than the empty and load brakes. This comes about from the use of one cylinder in place of two. A notched push rod and latch box are used with the load brake cylinder of the empty-and-load brake for the very important purpose of conserving air. Certain limitations associated with the use of two cylinders in a single set of brake levers make it necessaary to have several sizes of brake cylinders. The load compensating brake requires only one cylinder and it is only one size.

Variable-Load Brake Operation

Assume the brake system depleted and the car empty. The locomotive is coupled to the car and the air system is charging. While the brake pipe pressure rises from zero to 45 pounds the variable-load mechanism engages a suitable member on the truck below the truck springs to determine the degree of loading of the car. The springs being at maximum height because the car is empty, the weighing mechanism moves to empty car position. As the brake pipe pressure continues to increase, the registering mechanism is disengaged and locked so that car movement in transit does not produce false registration or unnecessary wear. The means for regulating the brake cylinder pressures, in accordance with the car weight, is in the form of a scale beam, the master end being under the influence of the braking pressure, the slave end measuring out the air under pressure that counter-acts the excess braking force. The beam fulcrum is shifted from one extreme position in which the brake-cylinder air pressure develops a corresponding counteracting pressure to the other extreme in which no counteracting pressure is developed. Intermediate positions of the beam fulcrum develop intermediate counteracting pressures.

Briefly the special parts of the load compensating equipment consist of a pneumatic pressure-changing device, a car spring deflection indicator and a new form of brake cylinder. The single brake cylinder is new in principle in that air under pressure is present on both sides of the piston under all but heavy car load conditions. From say three quarters to full load there is pressure on one side only. The pressure on the normal pressure side extends over the entire area and produces the force that pushes the brake shoes against the wheels.

The pressure that is on the reverse side extends only over the piston area that is not occupied by the hollow piston rod. This hollow rod as you know is open to the atmosphere so that the area within the hollow rod is open at all times to atmosphereic pressure only. In the load compensating brake cylinder the hollow rod is larger than normal and the area is designed to be adequate for braking the empty car. When the car is empty the piston area around the hollow rod is subjected to the same pressures as that on the other side but which is over the entire area so that the pressures on that portion of the two sides are neutralized leaving only the hollow rod area to produce braking force.

Action at Various Loads

Assume for the first example that the car is empty. A brake application will now develop the same pressure on both sides of the piston and the force available for braking is only that on the unbalanced area of the brake cylinder pressure. Let us assume next the car to be half loaded. The neutralizing pressure will be approximately one half that of the braking pressure so that the net force available for braking would be all of that on the unbalanced piston area plus the difference in pressures on the two sides of the remaining piston area. Finally, if the car is fully loaded there will be no air under pressure on the front side of the piston so that the force available for braking would be that from are air pressure on the entire piston area.

In this design we used for the first time in freight brake construction weight-saving materials wherever it is possible to use them. This together with the elimination of the second brake cylinder has brought about a substantial saving in the weight of the equipment. These materials are at the present time more costly than the conventional ones so that it is necessary to compare the advantages of weight saving with somewhat higher cost.

Brake Cylinder Release Valve

Finally, one additional new device has been developed and is now in trial service on a number of freight cars. This device has the dual function of semi-automatically isolating the auxiliary and emergency reservoirs and bleeding brake cylinder pressure prior to shifting cars as in hump yard service, and automatically restoring the normal arrangement when the brake system is recharged prior to again moving the cars. The device termed a brake cylinder release valve is installed in the brake-cylinder pipe between the AB valve and the brake cylinder. It normally provides an unrestricted passage for the air, but when it is desired to release the brake cylinder pressure a bleed valve comparable to the reservoir valves is pulled momentarily. The pressure between the AB valve and the brake cylinder release valve continues to hold the valve parts in the position set up by the trainman, that isolates the reservoirs and vents the brake cylinder, thereby permitting him to pass to the next car without waiting as it is now necessary to do with the reservoir release valves. When the AB valve is released by the restoration of brake pipe pressure the venting of the brake cylinder pipe between the AB valve and the brake cylinder release valve permits the automatic restoration of the latter to its normal position.

The time to release the cylinder pressure and later to recharge the brake system is reduced to a small fraction of the time required to bleed and recharge the complete system as is now necessary.

Recommended Changes in Design for

Reducing Diesel Maintenance*

A presentation of views on how to reduce maintenance and improve operation of Diesel-electric locomotives by changes in the power plant, chassis and running gear, and operating accessories

The Power Plant†

THE water-cooled lubricating oil cooler has proven the most successful type of cooler and should be made standard on all Diesels. The builders should give consideration to an easier and faster means of draining and filling crankcases, possibly from the outside of the unit.

Ample, in fact some reserve, cooling water capacity is essential on any type of Diesel. Manufacturers are urged to increase the number of radiator sections to combat excessive temperatures when working full load and while traversing territory of high altitudes.

Air scoops on roofs are necessary to cool enginerooms and to permit the entry of an adequate supply of air. We also believe and have demonstrated the need for roof exhaust shutters which, when operated with a properly designed automatic shutter-control system, goes a long way to improve cooling. More cooling air is required at the back of No. 2 engine on some makes of Diesels. The No. 2 traction motor blowers are not receiving a sufficient supply of air.

All engine-room air should be filtered. Boiler compartments should be partitioned off from the main engine room, and the air supply obtained from an independent source.

Electric pumps should be standard equipment to afford the transfer of boiler water to the engine-cooling system en route in emergency. Greater flexibility to avoid constant leakage is desired in the cooling water elbows. The present design is too rigid.

Improvement is needed in cooling-fan bearings and drives. Too much difficulty is being experienced with air-compressor valves sticking and carbonizing. This is due to the absence of a cooling arrangement on the air-compressor discharge to the main reservoir.

Some provision should be made in the cooling-water line to trap pieces of liner seals, hose, etc. Radiator sections should be so arranged that it will be a simple operation to blow them out. A considerable restriction in air flow across the radiators can occur in one trip. It is necessary to keep them free for proper air circulation and to be able to clean them during turning time.

Accessibility

Some more convenient arrangement should be provided for the removal and application of main engine blowers. At present it is necessary to move them through the locomotive, and to use a chain hoist. It takes about five hours for the change, and with short turning time this means delays. All cumbersome appliances should be moved through the side walls at points of use, unless provision has been made for handling through the roof where time is not a great factor.

Low-oil switches should be located closer to the top of the engine. The present location involves too much piping and causes the oil to become cold and the valves to stick. These switches should be arranged for positive engine shutdown.

All manufacturers are urged to eliminate cast crankcases. The fabricated cases are easier to repair.

More accessibility is needed to change electro-pneumatic controls. The leather packing should be discarded for heat-resisting packing cups. Too much time is now required for changes.

All air compressors should be electrically driven.

Maintenance Parts

Diesel locomotive builders seem to be more concerned in maintaining their schedules of producing new locomotives than furnishing parts to keep those in use operating. It is decidedly unfair to wait for material that is being used every day in the construction of new Diesels.

The numerous changes in models or types is loading our storehouses to the utmost, and in many cases it is necessary to expand or build new storage space. These changes all demand constant education and training of employes engaged in handling and using material. The multiplicity of locomotive types, even as concerns one builder, is ever increasing. We all feel progress and improvements are essential in the Diesel locomotive field, but the builder must not forget that we have an abundance of older Diesels which are being overhauled for the first time, and that they require pieces never used before. When the manufacturer makes all items available, the railroads can then embark on a sensible program of overhauls. Older types of Diesels cannot be considered obsolete.

Diesel engines were kept in service during the war through every possible means. Ingenuity, substitutes, repairs, in fact, haywire, etc., were put to use in place of the right parts and in consequence the demand for parts is now very great.

Chassis and Running Gear‡

The general design of the chassis and running gear of the present Diesel-electric road locomotive has been changed very little since it was first placed in general service. The structure of the body and underframe as a welded bridge truss was a radical departure from anything heretofore used, but the weight saved by its design has allowed the use of power equipment that otherwise could not be used. The service obtained from this chassis and their condition after more than two million miles of service indicate that with proper protection of the surfaces many more million miles of service can be expected and probably will be useful after the power and control equipment is economically obsolete. Consideration should, therefore, be given by the manufacturers to design bases, hatches,

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* An abstract of three papers presented before a session of the Railroad Division, American Society of Mechanical Engineers, at New York on December 4, 1946.

† By M. C. Sharp, Superintendent of Automotive Equipment, Chicago, Rock Island & Pacific.

‡ By G. F. Wiles, Supervisor of Diesel-electric Locomotive Operation, Baltimore & Ohio.

mountings and related parts to allow the application of improved engines, generators and control equipment.

The ideal would be to have a superstructure into which power equipment of any manufacture could be applied, but it is doubtful if this could be accomplished and it might result in hindering the design of new power and control equipment. But aside from these generalities, there are several conditions that have developed during the relatively short period of operation of these locomotives that could be corrected when they are being designed and built to reduce maintenance.

Inspection and Cleaning

Two of the major items of maintenance are inspection and cleaning. Covers that are secured by a large number of screws or bolts cannot be removed and re-applied readily, and many of them are secured by small screws, the threads of which soon become distorted. The covering of all possible parts that require periodic inspection should be secured by some means that does not require the removal of bolts and screws. Where it is necessary to use them, they should be of a substantial size and of a standard thread.

Portions of the superstructure that are subject to the accumulation of moisture and dirt, such as the bottom junction of the side members, should have some protection, such as cement, to prevent corrosion at these points. This would also assist in keeping the locomotive clean.

The cavities inside fabricated metal doors are subject to an accumulation of moisture and dirt and are showing considerable deterioration. Doors that are built of plywood with a metal covering are showing weakness at the points where the hinges and other parts attach. Consideration should be given to improving the design of these parts, and to attain a more rugged raising and lowering mechanism for door and window glass.

One of the principal features that has determined the high availability of these locomotives has been the ability to remove parts and re-apply new or reconditioned ones between runs. Maintenance could be reduced if door openings of sufficient size were provided to allow the removal of all parts that it may be necessary to replace without dissembling them or removing other portions of the chassis.

Considerable maintenance is required on the body side paneling of these locomotives and a more durable type of panel should be developed.

Couplers and Draft Gears

The shape of the front end ahead of the cab that has been developed has proved very substantial and offers the maximum of protection to the enginemen and resistance to damage when anything is struck, but the introduction of retractable couplers with draft gears has resulted in maintenance difficulties. These couplers have proven generally unsatisfactory, especially where it is necessary to attach and detach helpers on the road, and whenever it is necessary for the crews to operate them, whereas the standard arrangement of a coupler and draft gear that is in position for use at all times has proven very satisfactory from a safety and operating stand-point and requires less maintenance.

The pilot with its supports and braces should be designed with all strength possible to reduce damage to a minimum when anything is struck.

Inasmuch as the front end ahead of the cab on locomotives manufactured by the different builders are of a general similar contour, the windshield glass and mounting could be the same to reduce the parts necessary to carry in stock. This also applies to the door and window glass where standardization would not stifle or hinder design.

Floors must be designed to prevent slipping. This non-slip feature, and not plates, which become loose, collect dirt and moisture under them and deteriorate, should be an integral part of the floor.

Trucks

The trucks of modern Diesel-electric road locomotives have been of the very latest design and have given very good service, but, in the interest of reducing maintenance cost, they should be interchangeable from a locomotive of one builder to another. This would not require much change by any one builder, as the trucks of all the manufacturers are very similar in design and dimensions, divided into four-wheel and six-wheel types. The major items of design involved are the size and height of the center casting and the location of the side bearing surfaces.

The parts for these trucks should be made interchangeable as much as possible to reduce the stock necessary to have on hand; parts such as wheels, axles, drive gears, journal boxes, bearings, springs, air ducts, swing hanger pins and bushings, brake rigging and its pins and bushings, wear liners, etc., could be standardized without affecting any special features of individual trucks.

Sand boxes which are usually considered a part of the chassis should be constructed to prevent sand entering the engine room when filling them or while under any air pressure from stoppage of sand delivery pipes and all closures should be of metal; sand-box doors should be of a substantial design and require a minimum of maintenance to prevent moisture entering the sand box. No gaskets or seals should be required.

All piping under the floor should be accessible to repair without removing trucks or other major parts.

Cleaning the Locomotive

Inasmuch as the cleaning of the locomotives cannot be confined to the chassis and trucks alone, the locomotive as a whole will be discussed.

The cleaning of a Diesel-electric road locomotive cannot be performed properly during the time alloted between trips, nor done economically, by the application of cleaning medium by hand and then rinsing and wiping clean by the same method. It must be possible to perform the major portion of the cleaning by modern methods, such as spraying the surfaces with a cleaning solution and then rinsing by the same method.

To allow cleaning by this method, all surfaces of the interior walls and ceilings must be as smooth as possible and there must not be any ledges on which to accumulate or retain dirt or moisture. Electrical wiring and conduit should be located overhead between the generators and electrical cabinets and should extend down to the floor as near as possible directly over the equipment to which they carry current. This arrangement is to prevent oil, dirt and moisture seeping into the wiring and to prevent all possible exposure of the electrical wiring to damage underneath the locomotive. Air ducts must be adaptable to this type of cleaning. Electrical and other equipment that would be damaged by moisture must be enclosed or arranged so that it can be easily protected while cleaning the interior of the locomotive.

The floor should be oil tight with extensions above the floor around any protruding parts to prevent seepage of oil or water on the underframe, trucks and traction motors. No open drain pipes should extend underneath the locomotive; any necessary drainage en route should be into containers inside the engine room, to be emptied at terminals.

The exterior of the body of the locomotive can be

cleaned in modern car- and locomotive-washing machines, but sand boxes and air ducts must be designed so that water will not be forced where it will wet the sand or damage any equipment.

It is almost impossible to clean properly the underframing of present Diesel-electric road locomotives because of the numerous members, pipes, conduits, etc., collecting gear grease and other mixtures of oil and grease to which road dirt adheres and accumulates, and which can only be removed by scraping off by hand. Some arrangement should be provided to present a smooth surface which could be cleaned more easily.

Trucks should be so designed that ventilating openings into motors will be shielded to prevent the spraying of water into them when washing with water under pressure. Core openings into truck frames, bolsters, etc., should be closed to prevent the accumulation of oil and road dirt.

All of the above recommendations to prevent the accumulation of oil and dirt and to assist in keeping the locomotive clean would reduce the hazard of fire.

Switching Locomotives

The chassis and running gear of modern switching locomotives have been well designed to reduce maintenance. This applies to both integral cast-steel and fabricated underframes, but there are some improvements that could be made to further reduce maintenance.

The coupler carriers should be of ample strength to withstand the shock imposed. Spring hangers should be of a loop type to reduce damage when derailments occur. The spring hanger bolts and pins should be capable of removal without disturbing other parts. The hooded section over the engine should be removed easily in sections to permit replacing equipment with a minimum of preparatory work. Pipes, air ducts and other parts should not be secured to the hood covering, requiring their removal to remove the hood.

The recommendations for road locomotives to be designed to permit installation of later improved power and control equipment applies more so to switching locomotives, as does the standardization to allow interchang- drive gears, bearings, brake and spring hangers, pins ing of trucks, wheels, axles, cab glass, journal boxes, and bushings, and wear liners.

There is no doubt but that the manufacturers will improve their design to provide some of these recommendations which are essential and will coordinate to standardize as many parts as possible. This becomes more important as more of these locomotives are placed in service. If the manufacturers do not provide these improvements and standardization, then the railroads must prepare certain basic specifications and standards, but it is desirable that this be done by the manufacturers.

Accessories*

In order to improve maintenance of air brake equipment it is essential that locomotives be equipped with one standard type of equipment capable of modification to suit the various operating conditions encountered simply by adding to or removing certain valves or electro-pneumatic parts as desired. This would reduce the protective stock requirements and the testing facilities needed. Maintenance forces would become familiar with the equipment and turn out high calibre work. The 24 RL equipment should accomplish this end.

Our experience to date with modern equipment on Diesel-electric freight and passenger locomotive indicates that very little maintenance is necessary except for oil in the air brake system. A better oil filter should be developed than is now in common use to prevent oil from the air compressor entering the air distribution system. It is understood that some manufacturers are working toward this end. If and when such a filter or separator is proved to be successful it is altogether possible that the intervals between cleaning of air brake equipment can be practically extended.

The air compressor governing device would be of the synchronized type on road locomotives, preferably electrically interlocked so that the work will be divided equally between all air compressors. The unloading device on suction valves should be of the piston type to eliminate the failures and high maintenance required when fabric diaphragms are used. Air-intake filters should be of the oil-bath type or at least the type lending itself to ease of cleaning and re-oiling as is the case with main-engine air-intake filters.

Train Control

The modern installation of train control equipment to Diesel-electric locomotives has proved very satisfactory from a maintenance standpoint except for a few points peculiar to specific types of train control. Although there are several types of this equipment in operation in this country my remarks relative to maintenance will necessarily be confined to the type in service on locomotives of the New York Central System.

The speed governor used on these locomotives was, at the beginning, a maintenance problem. The manufacturer cooperated with us in the re-design of certain parts which has eliminated the troubles experienced. Mounting has been improved, contact fingers strengthened, contacts enlarged, contact blocks improved and minor changes in the centrifuge made. The net result has reduced maintenance to an inspection each week and a thorough overhaul at the time of quarterly inspections.

The equalizer-type receiver mounting has proved to be too weak, resulting in cracked brackets requiring much cutting and welding as well as replacing from time to time. A journal box mounting is being tried out which up to the present time has performed satisfactorily. However, the journal box must be re-designed to accommodate the mounting on locomotives using 36-in. wheels to obtain clearance between the receiver core and the lower part of box.

The locomotive builder and the signal companies should get together with the railroads and produce a mounting that will stand up under the conditions at which modern high-speed Diesel locomotives operate.

Couplers

Couplers themselves have not been a maintenance problem on our railroad. However, the retractable draft gear used on streamlined passenger locomotives has proved to be troublesome. This is known as the hydropneumatic retractable draft gear; the device is quite complicated, having a very close-fitting locking arrangement which becomes inoperative when a small amount of dirt and cinders work in between the locks and lock slots in the draft-gear frame. Delays have also been experienced due to crews becoming confused in the operation of the two valves used to retract or extend the draft gear.

It is strongly recommended that future locomotives be equipped with a counter-balanced drop coupler manually operated, or special doors to cover a standard coupler arrangement if it is desired to keep a streamlined appearance at the front end. It seems that from a crossing collision standpoint this is desirable.

* By F. Thomas, Assistant to General Superintendent of Motive Power, New York Central.

Fuel and Water Tanks

With fuel and water tanks located under the frame between the trucks no maintenance problem has been present with the exception of damaged tanks due to the locomotive striking some object—usually from grade crossing accidents where parts of the object struck get under the locomotive and puncture the tanks. All tanks should have a heavy guard at the ends and a guard under the sumps to reduce, if not eliminate, the damage normally sustained in accidents of this kind.

On future locomotives every effort must be made to provide ample fuel capacity for runs of 600 to 800 miles and water for runs of 400 to 500 miles. This will reduce the number of fuel and water stations needed, and, where such stations are properly spaced, provide ample margin of safety when operating delays are experienced or other emergencies arise. A steam syphon system has been developed on our railroad to allow water to be taken from track pans, or from a steam locomotive tender in case of long delays.

Communication Systems

All control circuits and jumper arrangements between units should be standardized by the various manufacturers so that mixed units of any make can be operated together. Communication, warning bell and indicating-light system should be included in this standardization.

The train communication system as used on our railroad has not presented any maintenance problem as standard air signal is used.

Radio equipment if used must be located in an accessible place for ease of maintenance and testing. If road locomotive applications do not vary extensively from that used on switching locomotives no serious maintenance problem is anticipated.

Train Heating

With Diesel-electric locomotives, train heating is one of the major problems both from a standpoint of maintenance and operation. Heating boilers now in use on the majority of railroads do not have sufficient capacity to heat as large a train in extremely cold weather as the locomotive can haul. When attempts are made to operate such trains the steam generators are operating at maximum capacity continuously. This of course is not a healthy condition as the slightest irregularity that may develop enroute results in a steam heat failure.

Crews endeavoring to get more steam from the equipment frequently increase the fuel pressure when signaled from the train for more heat, which results in boilers running in a superheat condition for long periods of time causing high-temperature steam to damage valves, cocks, and steam-heat connector joints. At times when this is carried too far the superheat switch trips resulting in a boiler shutting down for 10 to 15 minutes. When this occurs the last few cars in the train are almost certain to freeze before the steam generator can be placed back on the line.

The steam generators now in use also have many automatic features that have not proven too reliable and require excessive maintenance if failures are to be kept within reasonable limits. Every effort should be made to provide more rugged construction and to simplify the outfire relay, the stack switch, the high-temperature switch, and various gauges.

It is strongly recommended that a larger slow-speed pump be developed for steam-generator use. Feedwater pumps on the 2250-lb. steam generators are too small and must be run at such a high rate of speed to deliver sufficient water that considerable difficulty is experienced in the pump becoming air bound when the slightest suction leak develops.

Outside coils also have given trouble due to corrosion at the bottom three or four turns due to chemical action from the products of combustion condensing on the comparatively cool lower turns. The first five turns of the outer coils should be made of corrosion-resisting material to lengthen the life of the outer coil.

Trouble has also been experienced with small holes worn in the outer coils due to the impingement of steam from the soot blower lance tubes. Some other method of eliminating soot should be developed, such as the use of some type of soot destroyer injected at proper intervals, coupled with controlled combustion that will produce a minimum of soot.

We expect to install and test several of the new 3000-lb. steam generators which we are told are a great improvement over the older boilers and which have many of the previously mentioned weaknesses corrected.

Stainless Refrigerator Car

(*Continued from page 55*)

Trucks, Brakes, etc.

The car is equipped with A.S.F. Type A-3 Ride-Control trucks, with 5-in. by 9-in. wastepacked journals, 33-in. one-wear wrought-steel wheels, Asco journal-box lids, Creco No. 3 brake beams with leveling links, and Royal Type-F slack adjuster. Ajax hand brakes are installed.

The circulating moist-air refrigeration system in this car has been materially improved for a general-purpose car. Modern welding methods and the use of the latest developments in metals permit weight saving without sacrifice of strength. The car design is said to be adaptable to use of considerable aluminum, and other lighter construction for a particular railroad's requirements, if light weight is a major consideration. The new type door is expected to prove adaptable for use on all types of refrigerator cars. It is anticipated that the stainless steel ribbed siding will give long service life as well as attractive appearance.

E. M. D.'s All-Purpose Diesel

(*Continued from page 59*)

of the locomotive directly in front of the fuel tank. The engine control stand at the left of the enginemen's seat includes the engine speed throttle, transition and reverse levers. The type of transmission is optional and may be manual, automatic or a combination of the two. A multiple button control and lighting switch is conveniently located, also the usual air brake control valves, dead-man control, signal cord, sander valve, etc.

Automatic and independent air brakes are installed, with brake shoes on all wheels. The main reservoirs are carbon steel with all-welded seams and heads, 26½ in. by 50 in., capacity 25,000 cu. in. One reservoir is located under the cab floor while the second unit is mounted under the locomotive between the battery boxes in front of the fuel tank for a total capacity of 50,000 cu. in.

Air is supplied by a Gardner-Denver, two-stage, three-cylinder, air-cooled direct-coupled compressor, having a displacement of 180 cu. ft. per min. at 800 r.p.m.

Can We Step Up

Mechanical Department Effectiveness?

A prize competition announcement—$1,125 will be awarded for the best papers on three questions—The articles will appear in the June, 1947, issue

THE railroads of the United States and Canada were a vital factor in the prosecution of World War II to a successful military conclusion. Not only did they have to keep up the working strength of the continent—a major part of their normal function—but they had to move the raw and semi-finished materials and the finished products which gave America the right to the title of arsenal of the allied world, and their service was essential in assembling, training, and dispatching our own enormous military forces to the battle fronts of the world.

NOW that the war is over, and after a year during which the major problems inherited from the war and the postwar transition are taking shape, the need for clear vision and clear thinking with respect to the whole field of railway policies and practices was never greater. The *Railway Mechanical Engineer* knows that plenty of hard and constructive thinking is being directed at all of the problems pertaining to the selection, procurement, maintenance, and use of motive power and rolling stock. In order that the process may become more widespread and that conclusions may be reached and effective action taken sooner, the *Railway Mechanical Engineer* offers three sets of two prizes each, the first prize in each case to be $250 and the second $125, for the best papers submitted on or before May 1, 1947, on each of the following questions:

1. What is the problem of outstanding importance with respect to the maintenance and utilization of locomotives and what do you consider the best way to meet it? The following phases are suggestive only: Maximum utilization of steam locomotives. Maintenance policies and methods for Diesel locomotives. Shop and terminal facilities for either or both types of motive power.

2. The car department has come through the war facing some new problems and some old problems which now appear in much aggravated form. What do you think is the most important of these problems and what ought to be done about it? They may arise from the higher standards of comfort and convenience and the faster schedules to which today's passenger-train operation must adhere. There are also plenty of them associated with building up and maintaining an adequate supply of freight cars capable of moving the traffic safely and satisfactorily.

3. More than ever before intense operations under war conditions threw into striking relief the strategic importance of men in supervisory positions in building morale and securing greater efficiency from the forces under their direction. Incidentally, the same thing was true of all industry. If the railroads are successfully to meet the severe competition with which they are now threatened, every possible effort should be made to secure and maintain a high degree of morale and efficient operation. What can be done better to equip and strengthen the hands of men in supervisory positions to enable them to function more effectively?

PAPERS should not exceed 2,000 words and may be accompanied by photographs and drawings where these will be helpful. The same author may submit papers on more than one of the three subjects, in which case his entries will be judged independently. There are no restrictions on who may enter the contest. Decisions of the judges will be final. Articles other than the prize winners accepted for publication will be paid for at space rates. Address The Editor, *Railway Mechanical Engineer*, 30 Church Street, New York 7, N. Y.

EDITORIALS

A. C. Power For Passenger Cars

It is becoming evident that designers and users of passenger cars are coming more and more to the opinion that 30-volt electrical systems are inadequate for meeting new heavy service requirements. Residence and industrial lighting has established a.c. power as a standard, usually at 110 volts, and the greater part of motors manufactured are for use on a.c. circuits. Because of this it would seem that railroads should use similar systems on cars and take advantage of materials and apparatus made available at low cost by quantity production. It would also appear that a central source of power should be used on trains and this power be distributed by an a.c. transmission line. The situation is not quite similar since a house or shop may have to receive its power from a point many miles away, while the maximum transmission distance on a train is seldom more than 1,300 ft. As has been pointed out before, the principal obstacle to a central power source arises from the need for standardizing on type and location of connectors, and the fact that existing cars would require many changes. This difficulty somewhat reduces the attractiveness of a.c. systems but they are nevertheless being installed on passenger cars.

One railroad feels that neither a.c. nor a voltage as high as 110 is necessary. It uses a 60-volt d.c. system which cuts needed wire sizes in half as compared with a 30-volt system, and requires only a little more than half as many cells of battery as a 110-volt d.c. system. Fluorescent lights which work on 60 volts were developed for use on this system.

Original limitations which governed the choice of 30 volts were the battery, and the fact that the use of power was limited to lighting. It was felt that electrical equipment was a minor factor in car design and should not constitute a major cost item. Now batteries are more rugged and dependable and electrical equipment has become so important that considerable cost increases are justifiable. Those who wish to minimize battery requirements can do so by using generators and compressors driven by internal combustion engines.

The most recent development in passenger-car power is that of the Pennsylvania, described elsewhere in this issue. The cars are equipped first with a 110-volt d.c. generator, driven by gears from the axle when the train is in motion and by a 3-phase a.c. motor when it is desired to use standby power. The battery size has been increased somewhat by the greater number of cells and more by the fact that it has greater capacity than batteries used previously. The air-conditioning compressor motor is driven by unregulated d.c. power, and all other apparatus employs a.c. power; 110 volts for lights, and 220-volts, three-phase, for motors. Conversion is effected by a synchronous amplidyne inverter. Efficiency of the system is comparable with that of a d.c. system using regulated voltage for blower and exhaust fans and lighting or one in which the fans and blowers are run on regulated voltage and the fluorescent lights are operated from a motor-alternator. The amplidyne is new in railroad application, but it made an excellent record under rugged war service conditions. Its sensitive control is effected by a regulator without moving parts and the entire system employs brushes and commutators only on the generator and the amplidyne. It is to be expected it will give excellent service, and since the cars use a.c. power, they would present a minimum change-over problem, if at some time in the future, it should be desirable to use a head-end source of power.

Diesel Fire Prevention

Combustion takes place when fuel and air are in contact at ignition temperatures. This combination, when it is controlled in a boiler or an internal-combustion engine, is one of our greatest sources of energy for producing useful work. Uncontrolled, it is responsible for tremendous economic losses in the form of destructive fires. Some of the latter, now of considerable concern to the mechanical department, are those occurring in Diesel locomotives. As fires cannot start when any one or more of these three basic conditions is unsatisfied, the mechanical department should do its part in combating Diesel fire losses by eliminating as far as possible two of the contributing conditions, fuel and ignition temperatures, which are to some extent within its control.

The fuels or combustible materials that contribute to the starting of many Diesel fires are the fuel oil itself and the oil-saturated dirt, weeds and other debris that accumulate inside and underneath the locomotives. The fuel oil usually comes from leaks in the fuel pipe lines although the fuel oil supplying the combustible for some fires has come from a fuel tank ruptured by being struck by a flying object. Three of the igniting agents for Diesel fires are short-circuits in the wiring, flames from leaky or blown gaskets in the exhaust lines and brake-shoe sparks.

Good housekeeping and good maintenance is the best way to reduce these hazards. Certainly, the oil-saturated debris inside and underneath the locomotive can be removed at terminals if the right kind of cleaning attention is given to the locomotives, and leaky fuel lines should be rare with first-class inspection and maintenance. However, there will probably always be some fuel-oil seepage around the locomotive because some leaks are practically impossible to eliminate completely. While the rupturing of fuel-oil tanks is not a hazard that can be anticipated, shielding the tanks is not impossible.

Good electrical maintenance should eliminate short

circuits in the parts that are accessible for inspection and the same is true of gaskets as the prompt replacement of those in poor condition should keep the exhaust flames where they belong. No good answer has been found to the problem of brake-shoe sparks. Here, the best remedy seems to be that of keeping combustible materials out of their reach by routine cleaning of the oil-saturated dirt from underneath the locomotive.

With the mechanical department doing its part in removing the fire hazards from Diesel locomotives there is no reason why the losses from this source can not be reduced. The good records made by some of the railroads operating this type of motive power would indicate that the care given to the Diesel has a decided influence on the magnitude of the losses sustained.

The Freight-Car Outlook

Freight-car shortages, which were running close to 40,000 a week during the third quarter of 1946, were still over 28,000 during the week of December 21. During 1947 the probabilities are that the railways will be offered as much, if not more traffic than last year. That they will be able to handle all the traffic offered without car shortages as great as those in 1946, unless there is a substantial increase in the available cars, is beyond reason. Last year practically all the measures to conserve the car supply and to expedite car movement developed during the war were still in effect. These included heavy loading, prompt handling and low empty mileage—a much more intensive utilization than in 1941. Although O. D. T. is still exercising some control over the situation, there is no reason to expect any tighter control than during the war. Indeed, the tendency will more probably be in the direction of relaxation.

To have handled the traffic offered the railroads during the third quarter of 1946 without shortages would have required at least 140,000 more freight cars on line than were available. Upwards of 100,000 of these should have been box cars and the others open-top cars, mostly hoppers. What are the prospects of getting these cars during the coming year so that they will be available during the critical third quarter of 1947?

At a joint meeting of C.P.A.'s Steel Products Advisory Committee with a group of executives of the steel industry held at Washington on January 10 the establishment of a Freight Car Builders Industry Advisory Committee was decided upon in order to build up a freight-car output of at least 7,000 monthly. This compares with December production of 3,120, and November production of 3,244. The hope that the output could be raised to 10,000 cars a month received little encouragement. Not only is there competition on the part of light-gage rolled products for the steel needed to meet the requirements of steel plate and sheets for the car-building program, but car wheels and axles are also in "extremely tight supply" and wheels were mentioned as a probable limiting factor in increasing freight-car production. Reports were also received that most specialty manufacturers are quoting deliveries in the second and third quarters. The consensus of the committee, reported by the C.P.A., is that the program would "necessarily begin at lower levels" and "build up to an optimum of 7,000 units."

Through language phrased to present a shiny surface of optimism the discouraging facts can be glimpsed. If 7,000 cars a month were the output now and this were to continue through September 63,000 new freight cars would have been delivered in time for the fall traffic peak. More probable is a maximum of 50,000 cars. At retirement rates of the war years half of these cars will be required as replacements, leaving a net increase in cars on line of 25,000. No claims are made that these figures are of great accuracy, but who will deny that they represent a reasonable approximation of the unpromising prospects as they appear today?

Two Sides To Every Question

Almost from the day when the first few hundred Diesel-electric locomotives went into service on American railroads it was a generally accepted fact that this type of motive power would be maintained on a parts-replacement (or sub-assembly-replacement) basis with the idea of keeping the locomotive itself in actual service every possible hour of every day in the year. The design and structural characteristics of the Diesel lent themselves admirably to such a system of repair with the result that the availability—or utilization—of the Diesel has been so high that other forms of motive power have not only seemed inefficient by comparison but the supporters of Diesel power have, and will continue to, oppose any proposal to alter maintenance methods in any manner that will reduce the "in-service" hours of that type of power.

So completely has the parts-replacement idea been accepted in the Diesel field that many mechanical men believe that the availability (for service) of the steam locomotive can be greatly improved by the adoption of a similar system, particularly of back-shop repairs, wherein spare sub-assemblies—even spare boilers with their mountings—can continually be in process of overhaul in the shop to be applied to the locomotive when it is shopped for general repairs. (Incidentally, this idea is not new; it was used by some roads as long as 20 years ago).

It came somewhat as a shock to many railroad men when, during 1946, definite proposals were made to the effect that, as the age and number of units of Diesel power now in service increases, the railroads should give consideration to the idea of setting up a classified repair system for Diesel locomotives similar to that which has prevailed with respect to steam locomotives for many years. Immediately the opposition went into action with a campaign that to handicap Diesel power with the "out-of-service" time required for shopping on a "classified repair basis" would, in effect, be penalizing the owning railroad by tying up an expensive facility

that might well be in service 95 per cent of the time.

In discussing this question with a mechanical officer in the hope that we might gain some light on the possibility of increasing the serviceability of modern steam power by setting up such a system of back shop repairs, we were somewhat surprised by the comment that to have a complete set of locomotive parts, including a boiler, always in process in the shop with the idea of cutting down the shopping time of all locomotives of a like class would, in effect, be the same as having one (or more, depending on the total number of locomotives in the group) locomotive out of service 365 days a year.

Then too, where this complete locomotive "set" existed in the shop at a time of great motive power demand some one in the management might ask—and properly so—why the parts weren't made into an additional locomotive and put into service on the road.

This is *not* a discussion of the relative merits of progressive vs. classified repairs. It is, however, an attempt to draw attention to a fact that may have been overlooked, namely, that a backlog of repair parts equivalent in cost to the cost of a complete locomotive is actually in much the same category as a locomotive out of service 100 per cent of the time. Possibly a further study of the relationship of the cost of "in shop" time of a locomotive unit—whether it be steam, Diesel or electric—to the cost of carrying a heavy inventory of spare parts may disclose that the cost of "shopping time" is high enough to start thinking about the handicapping influence of obsolete maintenance facilities before investing in heavy inventories of parts to protect the service.

Designing Equipment For Maximum Eye-Appeal

Notable progress has been made in designing modern streamline passenger equipment, both locomotive and car, to have a high degree of eye-appeal and hence not only please the public but carry conviction that railroads which are progressive and up-to-date in this particular must be equally wide awake and able to serve in others. Consider the disillusionment, then, of a successful business man and possibly a big shipper who has just returned from a gratifying trip on his favorite streamliner and, while motoring to his office the next day, is stopped at a grade crossing on the same road and watches an ugly, dirty, clanking and rattling freight locomotive and cars in the same conditions go by!

While freight locomotives do not normally catch the public eye by operating at spectacular speeds along the road or bringing named trains to an impressive stop in crowded passenger stations, there are substantially more freight locomotives in service on most roads than any other type of power and they are probably seen by vastly more people in the aggregate. Why not, therefore, keep them as clean, attractive and noise free as practicable, so they will create a favorable impression on the public as well-maintained, efficient, modern motive power units? The possibilities along this line with switching power also should not be overlooked.

The most disturbing thing about the average freight train as it passes an observer, especially at speeds of forty to fifty miles an hour or more, is the vibration and ear-deafening roar of multitudinous metal parts pounding against each other, bouncing and careening car bodies, oscillating trucks, rattling brake gear and an occasional flat wheel which make even experienced railroad men sometimes wonder just how the train stays on the rails. So the first answer to creating a more favorable impression as freight trains traverse the country is to improve mechanical conditions. Replace old, worn-out cars with new equipment as fast as practicable and recondition older cars, installing modern trucks suitably sprung and snubbed to give a relatively smooth ride at modern high operating speeds.

Continuing for a moment on the subject of freight cars, probably not much can be done in the way of streamlining, although the full possibilities should be canvassed and some house cars have already been designed with rounded corners and pressed side paneling effects which are distinctly modernistic. Individual railroad monograms on car sides and well-painted exteriors are definitely within the range of use for all roads and have great advertising possibilities. To the somewhat natural question, "What good will it do to paint my cars when the other fellows look like rusty boxes on wheels," the answer is that a start must be made somewhere, and even one modern easy-riding freight car in a full train of old, poorly-maintained cars stands out like a beacon light in tribute to progressive management. It brings both public favor and maximum *net* earnings to the owning road or private car company.

Locomotives, both steam and Diesel, have been streamlined in the original design or subsequently equipped with streamline shrouding and painted in attractive color schemes and lines which harmonize with the balance of the train. In this decorative treatment, steam motive power has the advantage from one point of view, at least, in that the large driving wheels, rods and valve-gear parts may be utilized with dramatic effect, creating an impression of power and speed difficult to secure with the relatively smaller and less conspicuous driving wheels of Diesel locomotives.

So far, locomotive streamlining has been largely confined to passenger power and the thought is advanced in an earlier paragraph that this work, in modified form, at least, and accompanied by the use of modern paint color schemes and effective cleaning methods might well be extended to freight power. As a matter of fact, this has already been done to a limited extent. Early in 1946, for example, a Great Northern four-unit Diesel locomotive with black roof and two wide orange bands on the sides was used to haul upwards of 100 new refrigerator cars, painted with black roofs and ends, orange sides and decorated with the familiar Great Northern goat monogram. When this train passed, it is safe to say that few eyes were directed elsewhere. Similar results, although less spectacular in trains of mixed equipment, may be obtained by paying more attention to the eye-appeal of equipment both in passenger and freight service.

With the Car Foremen and Inspectors

Inspection Railroad Car Parts*

By C. B. Bryant†

Most failures in car parts occur progressively. I think we can say that we rarely have any car part failures that are due to inherent material deficiencies. They may be due to defects of material, but generally speaking, the materials we build cars out of are adequate for the purpose, if they are properly treated. Some failures are probably due to design. The Association of American Railroads has recognized that, for instance, in recent years by adopting a new design for passenger car axles which all of us believe will result in fewer failures in actual use. The main kind of failure we are fighting against and discussing here is the failure that develops progressively from little things we can't see.

Magnaflux is one means of detecting these failures before they get big enough to be serious, so that we can remove the defect and reclaim the part, maybe; or, if that isn't possible, we can scrap it and put in another one. I haven't felt in the past that the use of Magnaflux offered us a great deal in the inspection of new materials. I got the idea this morning that perhaps it does. On the A. A. R. specifications committee, of which I have been a member for some years, we have had a continuing argument with the manufacturers of car axles over what we say in specifications in words something like this: "The axle shall be finished in a workmanlike manner and shall be free of injurious defects"—leaving it to the poor devil of a material inspector to decide what defect is injurious and what isn't.

Inspection of New Car Axles

Manufacturers, of course, being on the opposite end of the inspection, are equally puzzled by what is injurious in the eyes of the inspector and they would like us to adopt a definition of injurious defects and have offered numerous versions of a definition which so far the A. A. R. specifications committee has not been willing to adopt. I have been one of those who have not been, although recognizing the desirability, because we didn't know how to evaluate these things. I am thinking particularly about the little black lines in journals and wheel seats that some people call tight seams and some call stringers and fine lines, and nobody knows exactly how bad they are and how long they can be or how many of them there can be in a journal and still be harmless, or how big they have to get before they become harmful. I learned this morning from Ray McBrian, (D. & R. G. W.) that some manufacturers of railroad car axles are offering the customer the privilege of conducting inspection with Magnaflux on new axles and when we get to the open part of this meeting, I hope that Mr. McBrian will be willing to stand up and tell us some of the details about that.

We have on our railroad recently had a series of accidents, some minor, some serious, due to failure of cast steel truck side frames. Mostly they were old, 20 or 25 years, with the old T and L-sections which are no longer made and against which there are restrictions drawn up in the A. A. R. interchange rules. We don't get all of those in our testing laboratory but we do get a percentage of them, so we can post-mortem and try to tell our mechanical men what to do to avoid similar failures. One thing that sticks out in our mind is how in the world they ever lasted as long as they did. All of you in the post-mortem business will recognize what I am going to say.

You have a fractured surface that is 30 per cent shrinkage space and the rest of it is steel. What steel is left is full of porosity and truly the only wonder is how it lasted so long, not that it broke. Perhaps, had we had Magnaflux 20 years ago, or whenever it was that the cast steel truck side frame began business, we could have avoided some of these accidents we are experiencing today. We know, of course, that the technique of the steel castings industry is immeasurably better today than it was when these earlier frames were made and yet, once in a while, I wonder if we might profitably look for porosity or shrinkage cavities in some of the castings we are making today. Maybe, we don't need to. I would like discussion on that if anybody is willing to give it.

Maintenance Inspections

The main application of Magnaflux in our work is the inspection of second-hand parts, maintenance inspections. The A. A. R. has recognized the necessity in that regard and in the Wheel and Axle Manual has made provisions calling for inspection with Magnaflux. Those of you who use the manual will recall that the last part of the book, Sec. 20, is the part that is made mandatory in its application through the A. A. R. rules of interchange. If we run a wheel shop or do any car repair work, that is wheel and axle work, we must conform to all requirements of Sec. 20 of the manual. Other sections are advisory in nature and recommending, but this one you have to do.

One of the provisions in that mandatory section is Par. 355, Sec. (o). "If a journal surface has pronounced coloring due to overheating, or if circumferential checks or cracks are found, or if cracks are found in wheel seats, the axle must be scrapped, unless such checks or cracks can be turned out without going below the con-

* Partial report of a Railroad Magnaflux Conference held at Chicago early in 1946.

† Mr. Bryant, chief engineer, Technical Board, Wrought Steel Wheel Industry, was assistant to the vice-president, Southern, at the time of the Conference.

demning limits, and the axle inspected with Magnaflux before being put back into service."

There you have a definite provision which is mandatory practice that enables you to re-use an overheated axle only after it has successfully passed inspection with Magnaflux. I don't know how completely that provision is being respected. The A. A. R. has a corps of mechanical inspectors who spend a good bit of time going around to various shop operations, particularly wheel and axle shops on railroads, and unfortunately, I don't think that rule is 100 per cent effective. It is an excellent rule and it is gradually being policed up to a point of being much more effective than formerly.

On the Southern we try to follow that practice. I will read you this, it is short enough—Magnetic Inspection Circular No. 3; this is a memorandum from our chief mechanical officer to all master mechanics: "Test all used axles before returning them to service when axles, with or without mounted wheels, are in the shop for any purpose. The entire axle, including wheel seats, should be tested when wheels are dismounted. Journals, journal fillets and entire body of axle between wheels should be tested when wheels do not have to be removed. (All pulleys, drives, boxes, roller bearings, inner races or sleeves should be removed whenever wheels are dismounted and entire axle should be tested.)"

Then, in passenger car shops—"The following passenger car parts are to be inspected with Magnaflux . . . each time they are removed for any purpose: truck equalizers, truck spring hangers, coupler yokes, coupler stems . . ."

We have some complete instructions and I think nicely prepared forms which are designed to make it easy for the shop people to keep a record. I believe this is an important part of this operation.

We mentioned passenger car equalizers. I suppose other railroad people have had similar disastrous experiences with passenger car equalizers not inspected with Magnaflux. We had two quite serious accidents some time ago, due to the fact that we were not at that time inspecting equalizers with Magnaflux. We have learned the hard way. I would like somebody this afternoon to talk about the inspection of couplers. We have had a lot of couplers fail. The heads drop down to the track and derail equipment. We have had a good many accidents on that score. To what extent can couplers be examined with Magnaflux in order to find out whether they are progressively failing? Those that we get into the laboratory, I think, invariably have shown they are progressive failures. We may be able to save ourselves some accidents in that way. It is a lot more important than the cost of metal and the cost of putting in a new coupler. It can result in the derailing of everything behind in the train.

Inspection of Welded Parts

The A. A. R., to my sorrow, has been—somebody will jump me on this—permitting, as a war-time measure, the welding of things that I think should be unwelded, not that I am against welding in general. I am talking particularly about truck side frames. Coupler yokes you can weld now and, of course, you can weld couplers to almost any degree. I would like to have some discussion on the inspection with Magnaflux or any other suitable means, if Magnaflux is not suitable, of the welded repairs of truck side frames.

Through the years, we have made inspection of new truck side frames in the foundry. If anybody welded, no matter how slight a shrinkage crack in a tension member, we would reject the frames. The manufacturers of the frames didn't kick on that. They felt the same way. And now they permit welding in railroad shops where the welding conditions, I hazard a guess, are not anywhere near what they are in the foundries where the frames are produced. If we can inspect the results of that welding work in some way and assure ourselves it has been properly done, it would be very worthwhile. Whether that will remain in the interchange rules of the A. A. R. after the war is officially over, I don't know. It was put in as a war-time conservation-of-material measure. It may have been entirely justified at the time. This isn't the place to debate the wisdom of the A. A. R. rules, but that particular change brings up a problem appropriate to this meeting.

A question has come up as to whether or not we ought to inspect wheels with Magnaflux. I don't know who is doing it. Mr. McBrian said they had experimented a little bit with it on his railroad. We don't on ours and I have no knowledge whatever as to what other railroads are doing. We do have wheel failures of types of progressive fractures, particularly thermal cracks, seams in iron wheels and, if we know they were there sooner, we could take the wheel off and save ourselves an accident. I think that would be an excellent item for discussion if any of you have thoughts on it.

Inspection Cost a Factor

In car parts, we usually have a good many and the question of the economics of inspection with Magnaflux comes in because the sheer physical labor of handling axles and other heavy things up to a Magnaflux bench or getting the Magnaflux machine to the testing station, no matter how you do it, may be an expensive operation, if not properly done, and we all know that our managements tend to question an operation if it is too expensive. I would like to have some talk, if we can this afternoon, on the mechanical layouts, mechanical handling methods of inspection with Magnaflux of car axles, for instance. That is one of the main items. How do you get them all together? Do you inspect them with Magnaflux before you turn the journals and wheel seats or afterwards and how do you handle them, lay them out on skids, or what? Some of us must have better methods of doing that than others. We can contribute a great deal to the economy of inspection with Magnaflux, if it is efficiently handled.

Discussion

Ray McBrian (D. & R. G. W.): In the last four years, on all new car orders, we have been inspecting all axles. We worked out with one of the steel companies an acceptance and rejection clause. It is about half a page in length, and briefly, it is this. We accept nothing that shows by Magnaflux as transverse defects. For example, year before last, we inspected 2,000 axles on 500 cars and we scrapped two axles with transverse cracks in the center of the axle.

Any seams or discontinuities that are found that intersect the machined fillet or the machined surface and cannot be removed will, of course, result in scrapping the axle. We do not inspect the axles on mill inspection. The axles are shipped to the car builder. We send our Magnaflux operator and the Magnaflux machine back to the car builders and set up as the axles come off the lathe to do our inspection there. We are now inspecting axles at one of the steel car companies. We just had an order for 250 more ballast cars, which went to another car company, and included our inspection with Magnaflux clause and they wrote back and told us that if we persisted in this, it would require a large extra because it required Magnaflux quality steel. We sent them a copy of our specifications, which had been agreed on

with the steel company as to what was acceptable and what was not. They wrote back and told us that it was entirely satisfactory and they will go ahead with the inspection with Magnaflux.

Gordon Adler (A. T. & S. F.): The Santa Fe has similar specifications. I don't know whether it is a manufacturer's specification but our inspectors use it and, as I recall, it says that all seams over 1¼ in. will be totaled and if the total length is over 2¼ in., we reject the axle; or, if there is any seam ½ in. long, it would be cause for rejection. If any of the seams lie in the fillets or over the corners, they won't be acceptable. That applies to the journals and the dust guard collars and the wheel seats. We are not so particular for the body of the axle. That applies to longitudinal seams; transverse seams are all out—we won't take those. If there is any machining to save the part without reducing its strength or going below the minimum specified dimensions, we will accept the machining.

There is a possibility that Magnaflux will extend the seam a little bit longer than ordinarily found by visual examination. As far as I have been able to determine there isn't much advantage in going to Magnaflux, although we did use it on the one occasion to be sure of ourselves. Specifically, we were using it on hollow, seamless axles and we were interested in going into the bore of the axle to find out what condition existed in the bore. In doing that, of course, we were able to get the seams on the surface too.

A. S. Pedrick (S. P.): We are working toward the inspection with Magnaflux of all dismounted car axles. I would like to have a little discussion as to the exact method of inspecting car axles. Our present recommended practice is to use a three-turn coil and alternating current of about 400 amp. We thoroughly inspect the axle with the coil over the entire length and then as an additional test, if we find any seams, we use the leeches. Usually, we can pick up some longitudinal seams by twisting the coil and distorting the field. This gives us an indication that there is something there and by giving the axle the leech test, we usually can find extensive seams. I was wondering just what other roads are doing, whether they are using the leech test or circular magnetism on axles. Although many seams may be found using a circular magnetic field, I realize that these seams are usually not of serious nature and axles are seldom scrapped from that cause.

Russell Herman (Southern): I can tell you, roughly, our procedure. We have just recently started on a large scale, but have been using Magnaflux for about a year and a half on a rather small scale and in locomotive shops. Before we started or made any move at all in the wheel shops, we made some investigation and gave thorough consideration to several different schemes. We were quite interested at the start in the yoke method of testing which, you know, is being used on at least one eastern railroad. We constructed one of those machines and tested it out in comparison with the a. c. machine but decided the a. c. machine would give us a much more definite indication of the crack than we got with the d. c. yoke machine using the wet method. We are going to have to keep close check on our testing operation because there are times when the man assigned to the machine will change to other work. Test benches have been constructed out of structural steel with overhanging supports for the axle. The axle itself is mounted on a roller bearing faced with fiber or bronze to avoid scarring the journals.

We use a movable coil. The bench is something similar to an ordinary lathe so that the coil can be moved back out of the way, and that lets us handle an axle in and out of the machine with an electric hoist which saves labor and time. We make three passes over the axle with the coil, covering about one-third of the axle on each pass, and use the powder blower since that speeds up the operation quite a bit as compared with a shaker.

Mr. Pedrick: In regard to the leeches—to what extent do you use them?

Mr. Herman: We haven't given any consideration at all to the leeches for circular magnetization. We felt that the longitudinal seams or fissures are not important but may change later on. At present, we are interested only in the transverse cracks.

Regarding records, as far as freight car axles are concerned, we don't keep any record. That is, there is no means of keeping the record of the origin of the axle, the date it was purchased, or where it came from. We have three report forms. The shop making the test keeps a record of the number of axles tested. After the test is made, they brush with a yellow paint on the center of the axle the date and the letters "MF" to indicate that it was inspected with Magnaflux on a certain date. Once each month, they get a summary of the total number of axles tested during the particular month in that shop and send that form in to the general office.

In addition, they send in individual forms covering all broken parts indicating on them where the crack was found, the extent of the crack, and any other information that they can furnish. On roller bearing axles or any other axles that are stamped, they furnish detailed information of the stamping, the date the axle was manufactured, etc. The same thing applies to locomotive parts, so what we secure from the shops are individual reports on each scrapped part. We secure a monthly summary of the total number of parts tested and the number found cracked and the number reclaimed. When it comes to passenger cars or locomotive equipment, the shops keep an individual form for each locomotive going through the shop and they list on it all the parts that are tested, together with the parts that were found cracked and reclaimed. We feel with that set of forms, which is similar to those in use on the Baltimore & Ohio, the Norfolk & Western, and various other railroads, we have a complete record of the entire testing setup.

Mr. Max Herzog (Frisco): I was interested in Mr. Herman's statement that they attach no importance to longitudinal seams. I would like to ask if anyone has any clear-cut evidence that longitudinal seams in an axle ever caused a failure. I have never seen any and if that is generally the experience, there seems to be no reason for testing for seams with Magnaflux. Test only for transverse cracks.

Mr. Pedrick: I have found that when a few seams are located by the coil method, twisting the coil and putting the leeches on, there are times when there are hundreds of seams and some of them extend right through the wheel seat and into the journal and they were entirely overlooked by other methods of inspection.

Mr. Herzog: Have you ever seen a failure?

Mr. Pedrick: I can't say I have, but the seams exist and they can be found readily with circular magnetism.

J. D. Mays (F. E. C.): I have seen longitudinal cracks in an axle open up the entire length of the journals. I have found them in my shop and removed them for that purpose.

Chairman Bryant: Was that associated with overheating, Mr. Mays, or under normal operation?

Mr. Mays: At the time the axle came to the shop it showed no indication whatever of overheating, although I did assume it originally started from that.

C. R. Pflasterer (U. P.): On the Union Pacific, we

have found we can trace it to a longitudinal seam. We inspect them with Magnaflux.

H. G. Moore (A. C. L.): I would like to ask Mr. Herman in regard to the method he uses of inspecting the axle with Magnaflux. Do you turn the wheel seat before you make the inspection with Magnaflux?

Mr. Herman: As I understand it, some railroads make a practice of testing when axles come in the shop. However, those same railroads make a second test after the axles are machined. It seems to us that there are numerous small cracks you might find before turning that, after you turn the wheel seat, would be turned out, and it is our practice to test the axle after it is machined.

Mr. Moore: I wonder if there is anyone present that has had the experience of testing with Magnaflux before they were machined? The point I am making is, after a journal is turned and burnished, the roll will tend to conceal the crack that might exist there. I wonder if Magnaflux would detect cracks after the surface has been rolled.

Copper Penetration Cracks

J. J. Laudig (D. L. & W.): I have never found that Magnaflux properly shows when an axle is overheated. The cracks that come from overheating are not exactly open cracks, but they are copper penetration cracks along the grain boundaries of the steel and you cannot find them with Magnaflux. Any axle that subsequently fails wipes out all opportunity to find the previous overheating that occurred unless the axle happens to fail by fatigue, in which event you will find it. Otherwise, it usually develops a secondary overheating of the journal, the copper penetration proceeds much deeper and you get a burned off journal with just a regular copper penetration failure.

It seems to me that the A. A. R. should anticipate this condition and change the kind of a journal back that is now being used, because copper penetration is the thing that we have to guard against. We have it ever present with us within 1/16 in. of the journal and, when the brass comes in contact with the steel under bending and stress, you get copper penetration. Magnaflux does not pick it up because there is no actual opening of the crack there. I think that the problem of overheating of car journals is something that is very important and has to be given added consideration.

W. E. Thomas (Magnaflux Corporation): May I ask Mr. Laudig how deep this copper penetration goes?

Mr. Laudig: I have specimens that were taken out of the car shops, but I can't tell you how far they have gone in copper penetration. After you have the first overheating, which may not respond to Magnaflux, you develop a second hot box afterwards and copper penetration definitely goes on, but I have penetration anywhere from 1/16 in. on down to 1 in. under the surface.

C. E. Betz (Magnaflux Corporation): For the purposes of inspection with Magnaflux, a crack and a line of copper penetration are entirely similar, so that we would expect it to be just as easy, if the magnetization procedures are right, to show copper penetration as it would be if the same amount of metal were open by a crack; but actually, I believe, the reason that the copper penetration of heated journals does not always show well with Magnaflux is that at the surface where the copper enters the journal, you do not have just a single line of copper penetration. You have a number of small entering points which then tend to work together and deeper down, perhaps, become a more concentrated penetration. It would seem to me that the proper time to inspect journals which may have had copper penetration is after turning because, then, you are down into the metal far enough that you may be able to pick up the copper penetration area, due to the fact that it is more likely to be a single line of penetration at that depth.

As regards the effect of burnishing in Magnaflux inspections, we definitely prefer to see the inspection made before burnishing, because the burnishing operation tends to seal cold-worked metal over the surface of the crack and makes it, if not unfindable, certainly more difficult to find. The shallower the crack, the harder it is to find after burnishing. The deeper the crack, the less detrimental burnishing is with Magnaflux inspection.

Truck Side Frames

Chairman Bryant: I am still hoping somebody will talk about truck side frames. I can't seem to get any offers on that.

Mr. Reid: I don't know of any road that is checking truck side frames in their normal procedure, but just out of curiosity we checked one the other day and found a crack probably three inches long going through both sides of the cast steel frame. I think now they are going to give serious consideration to checking all frames. This particular one was just accidental.

Chairman Bryant: Would you like to say how you did it? I think that would be interesting. How did you effect the magnetization?

Mr. Reid: We just put a cable through one of the large openings in the frame, wrapped it around one section. This crack was on the top member about three inches from the journal box and there wasn't any question about what the indication was. The crack went through the entire thickness of the frame.

Chairman Bryant: Was the crack visible after you had located it with Magnaflux and knew where it was?

Mr. Reid: After we had cleaned it with a wire brush, we could see it.

Chairman Bryant: Was that a T-section, L-section, or U-section that you tested?

Mr. Reid: I believe it was a U-section frame. I couldn't be positive.

Chairman Bryant: As far as I know, no truck side frames are being made today except the U-section.

Mr. Thomas: What do you think about welding repairs on such cracks?

Chairman Bryant: If I am in good mental shape and remember the interchange rules correctly, it is now forbidden to weld cracks in truck side frames of angular or T-sections. There must be some interchange experts here.

Member: That is right.

Chairman Bryant: You can't weld them, but you can weld the present U-shape section. You have to stress-relieve. I am still dubious about it, though.

Passenger Car Equalizers

Mr. Crossett: About two years ago, we instituted a program for equalizers where the fillet was ground out with a 1½ in. radius. The radius was measured and all the forging holes and wrinkles were ground free and the equalizers inspected with Magnaflux. As of today, we haven't had one of those fail. We also, at the same time, throw out equalizers that have any welding on them, not that we object to welding along the pedestal faces, but in some cases, we have had equalizers fail where the cracks were underneath the welds. The welds covered up the cracks and couldn't be followed. So, at the same time, we throw out all the welded equalizers.

Chairman Bryant: That is standard practice on the Milwaukee?

Mr. Crossett: Yes, sir. The only welding we permit now is to put a pad on, and that pad is welded along

the outer face at the ends of the equalizer and not where the slot fits over the drilling box. *It is all out in the unstressed areas.*

Chairman Bryant: I am thinking about my own railroad. We weld them. Does anyone else have comments on the equalizer problem?

Member: Ours are brought into the main blacksmith shop first. They are brought back and gaged. They are then normalized. Then, they are tested with Magnaflux and inspected afterwards.

E. J. Hausbach (Wabash): I would like to ask the gentleman if they weld up the box seat of the passenger car equalizers when worn, and how far back on the box seat of the equalizer they go with the welds? Do they build up the box pad back to the fillet of the throat or fillet?

Mr. Crossett: You mean on new pads, sir?

Mr. Hausbach: Yes.

Mr. Crossett: Well, all the welding there is, is a little half-round groove that fits over the journal box. All the welding is confined to the outside of that groove.

Mr. Hausbach: You don't weld up any of the ends of equalizer seats that fit on the journal box?

Mr. Crossett: No, sir.

Mr. Hausbach: We weld or build up worn equalizer box seats but do not weld back to the fillet or throat. We leave the original fillet or throat in the equalizer.

Chairman Bryant: That has been our practice also.

Mr. Hausbach: When equalizers are worn to the limit, we build or weld them up to the standard thickness and when again worn to the limit, we do the same thing over again. If they wear below the limit, we scrap the equalizer. All equalizers are brought in the shop, sand blasted, and inspected with Magnaflux. If no defects are found, they go to the blacksmith shop and are built up to original thickness, then annealed. When brought back to the machine shop to be machined off, they are inspected with Magnaflux before being machined and again after machining.

The 3¼ in. limit was only used for an illustration, as we have a minimum and a maximum thickness for each end of the passenger car equalizers which are made from .1010 low carbon steel.

Brake Beam Tension Rods

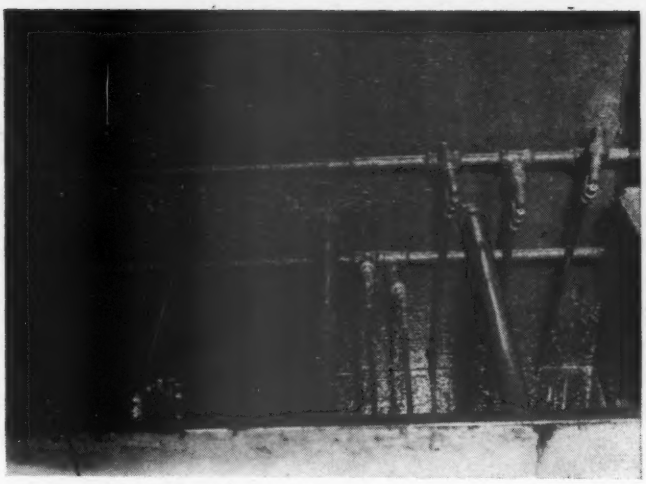
W. P. Stewart (I. C.): I wonder if anybody has had any experience in using Magnaflux on the threaded end of a brake beam tension rod, where they are used second-hand? Can those fractures or cracks be discovered down in the threads.

Co-Chairman Betz: I don't say that I know anything about that particular problem, but finding cracks in threads on bolts and soft materials is one of the common problems that use of Magnaflux is called upon to solve in other industries; so, I would say in answer to your question, it can be done.

Spraying Priming Coat on New Lumber

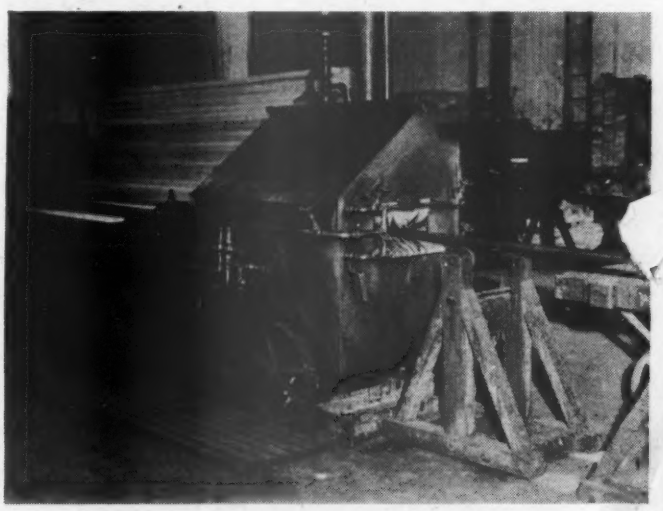
Special spray-painting equipment is used to put a priming coat on the large volume of new lumber prepared by the Canadian Pacific at its Angus shops, Montreal, Que., for use in the construction or repair of freight and passenger cars.

The equipment, made at the shops, consists of an enclosed portable metal cabinet through which the boards are passed and painted by a battery of spray nozzles as they go through. An air motor rotates a roller at one end



Five nozzles on one side are positioned to spray paint on the top, bottom and one edge of each board—A similar set of nozzles is located on the opposite side of the cabinet's interior

of the cabinet which pulls the boards into the cabinet and also forces them through as successive pieces are placed on the roller. Inside the cabinet a battery of spray nozzles are located on both sides and are positioned to spray paint on all of the sides and edges of the boards as they pass once through the cabinet. By the operation of valves in the air lines the nozzles on any one pipe line may be adjusted or turned off or on as required. The bottom of the cabinet acts as the paint reservoir and the paint is drawn from that location to each nozzle by the action of the air passing over the end of a pipe leading from each nozzle to the bottom of the tank. The boards are carried on three rollers inside the cabinet, the rollers being lo-

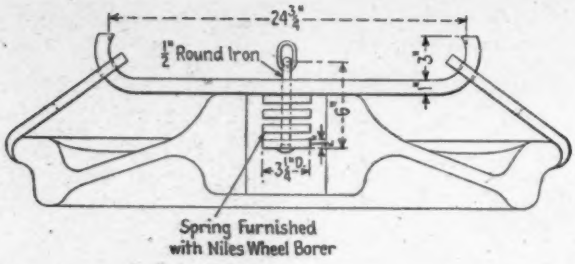


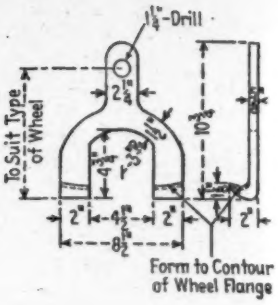
The spray-painting cabinet in operation

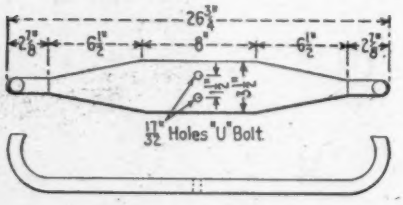
cated with respect to the nozzles so that the latter are above and below the boards as they go through. A cover is hinged to the top of the cabinet to facilitate the replenishment of the paint supply and adjustments to the equipment. To keep the paint from being sprayed through the openings for the boards the openings are protected by canvas.

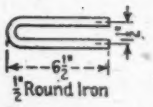
Two men operate the equipment, one man feeding the lumber into the cabinet and one man removing the boards and piling them directly on a wagon for movement to the car shops. As the lumber has been kiln dried the application of the priming coat protects it from picking up moisture while it is in storage awaiting use and also acts as a base for the finish painting operation.

Wheel Shop Handling Devices



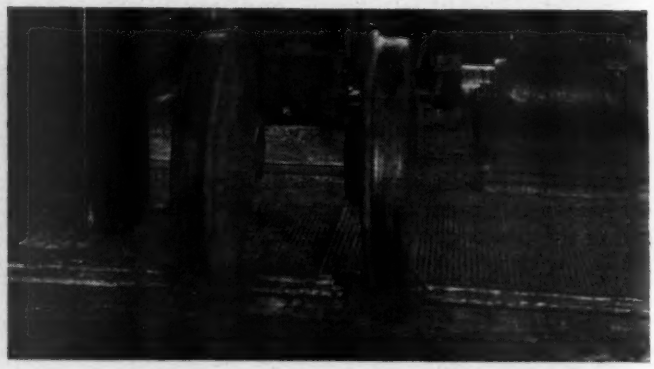


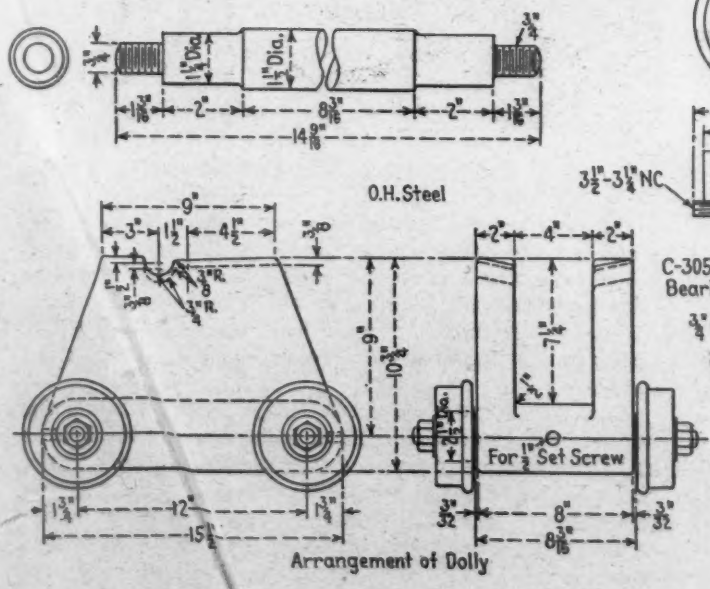


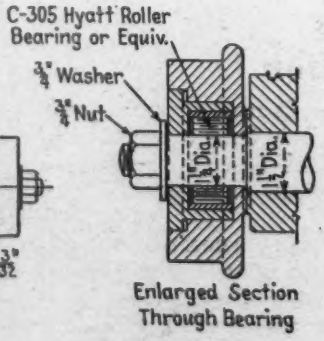


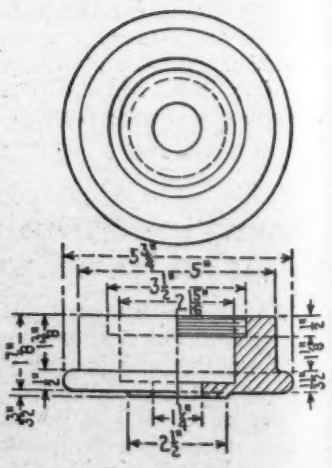
O.H. Steel

On this page are shown two handling devices used at the Glenwood wheel shop of the Baltimore & Ohio. Above and at the left is the device used with cranes on the Niles boring mills to lift wheels on and off the machines. Below and at the bottom of the page is shown the wheel dolly employed to hold the wheels in a vertical position after the axle has been removed at the dismounting press and before the axle is applied at the mounting press—The dolly runs on tracks located below the floor level. [Other wheel and axle handling devices used at this shop will be described in subsequent issues—Editor]









IN THE BACK SHOP AND ENGINEHOUSE

Engine Failures

[In a preceding issue appeared an abstract of the paper entitled, "Engine Failures," presented by James Grant, superintendent of motive power, Atlantic Coast Line, before a meeting of the Southern & Southwestern Railway Club, at the Ansley Hotel, Atlanta, Ga., on September 19, 1946. In this issue an abstract of the written discussion of the subject by A. T. Miller, assistant superintendent of motive power, Atlanta & West Point, and his answers to questoins from the floor appear. Additional oral discussion of the paper will be published in a later issue.—Editor.]

One of the most important things in connection with efforts to prevent engine failures is good close inspection, and regular inspection. At each monthly, quarterly and annual inspection, certain inspections and tests are made that are in addition to those required by the Federal inspection rules. These additional items have been adopted, one at a time, over the years, and each is the outgrowth of some actual experience. By providing a regular supplementary inspection form on which these items must be reported in writing and by gearing these inspections with the Federal inspections we made sure that none of them will be overlooked. The additional items are given below.

Monthly Inspection

Close and open valves to Prime cylinder protection valves to test operating screws, and also burn out control pipe.

Remove bonnet to valve in pipe from blow-off cock to remove scale or bolts.

Remove bonnet and examine discs to cut off valves in boiler checks.

Oil reverse gear valve and cylinder.

Clean feed valves.

Examine cylinder drain pipes.

Quarterly Inspections

Same items as covered by monthly inspections with following additional items:

Remove low water alarm drop pipe plug and examine and clean drop pipe.

Remove and clean out whistle and valve to low water alarm.

Remove, clean and repair pump governor.

Test and repair signal equipment each six months or at every other quarterly inspection.

Remove and anneal steam gauge syphon.

Test steam line to power reverse gear.

Remove all rods from engine, clean and inspect for worn bushings and Magnaflux.

Remove all knuckle pins and examine for fits in rods.

Remove cylinder and valve heads. Clean carbon from valves and gauge steam cylinder piston heads for wear (limit ¼ in.).

Examine valve stem fits.

Remove and examine valve stem keys.

Remove engine truck and trailer truck brasses for inspection.

Remove all tender brasses and wedges for inspection.

Remove and clean generator governor and set voltage.

Remove and graphite all caps, plugs, etc., used for substituting hose for metal conduits on both engine and tank.

Remove and place in good condition all emergency tools and supplies.

Annual Inspections

Same items as covered by monthly and quarterly inspections with following additional items:

Examine throttle rigging and throttle box inside boiler.

Examine drop pipe to low water alarm over crown sheet.

Examine drain valve nipple to water column.

Anneal draw bars.

Remove back tender coupler and draft gear for inspection.

Apply hydrostatic and hammer test to main reservoir each twelve months instead of eighteen months (I.C.C. requirements are to apply hydrostatic test every 12 months and hammer test every 18 months).

When the locomotives are sent to outlying points or assignments where no maintenance forces are available they are, of course, given Federal inspection just before being forwarded and in addition certain special inspections and tests are made (and reported in writing) to insure the locomotive being in condition to remain on the assignment until it has to be relieved or worked back to shop for the next Federal inspection. Each inspection or test is signed for by the individual making it and the entire report certified by the foreman. The items are:

Driving boxes repacked with full grease cakes .....
Engine truck boxes repacked and brasses examined....
Tender truck boxes repacked and brasses examined....
Engine truck lateral checked .....
Valve motion pins and bushings checked .....
Crosshead gib lining .....
Rod bushings checked for wear and lateral .....
Driving springs, hangers and equalizers .....
Brake beams, hangers, hanger pins and shoes .....
Valve stem packing .....
Piston rod packing .....
Air pumps and brake valves tested .....
Engine brakes adjusted .....
Tender brakes adjusted .....
Sufficient adjustment in buffer wedges .....
Front end and ash pan .....
Flues clean and tight .....
Brick arch .....
Tools and equipment in supply box .....
Other standard emergency tools and equipment .....
Tire wear ..... Thickness .....
Flange thickness .....

I have personally inspected and supervised work on this locomotive and certify it to be in condition for a full period of service.

.....
Foreman.

We feel that these practices have been quite helpful to us in our efforts to keep down failures. Of course, the whole idea is that everybody makes certain periodic inspections over and above what is required by Federal rules and we have merely gotten them all together and tied them in with our regular Federal inspections and that form is filed just the same as the Federal report.

Oral Discussion

Q.—How often do you magnaflux rods?

A.—At every quarterly inspection when they come down.

Q.—How often do you blow flues and examine the front end?

A.—We are supposed to do that every trip.

Q.—How long does it take you to get quarterly inspection?

A.—We usually take about eight hours; we clean all our rods and send them to the magnaflux machine.

Q.—How many men does it take to do it in eight hours?

A.—We use one pipe man, one air man, one cab man and two floor machinists. Of course the pipe man, the air man and the cab man are only used part of the eight hours.

Q.—How many man hours does it take to make an inspection including men making parts, etc.? I want the full details on it—I have never been able to do it in eight hours.

A.—Lots of times you can do it in less than eight hours, taking in the blacksmith work or Magnafluxing; just throwing the rods on the floor and cleaning them. We make it most of the time with two men and most of the time in less than eight hours. Just the other day we gave a big locomotive a quarterly inspection, including renewing two rod bushings, two knuckle bushings, pulled valves and cleaned carbon; we built up both piston heads, turned them and finished in eight hours.

Q.—How many miles do you get per engine failure?

A.—I haven't figured it out on just that basis but I do have these figures for the year 1945, and considering only mechanical failures we handled 18,975 trains with 99.42 per cent reaching the final terminal without mechanical delay and for the first six months of 1946 we handled 10,350 trains with 99.78 per cent reaching final terminal without mechanical delay.

Q.—Do you use sectional packing and what mileage does it give?

A.—Yes, we use sectional cylinder packing and it ordinarily runs from shopping to shopping.

Q.—Do you remove rods on quarterly inspection?

A.—Yes, we remove and Magnaflux all rods at each quarterly inspection.

Q.—Do you take the rods off or just the collars off?

A.—We take the rods off and put them on benches and caliper the bushings and pins.

[Remarks by questioner—Before we got all this modern machinery we used to have rods lying all over the place in the roundhouse, but now we find it to be cheaper and better not to tear all these parts down. We had lots of failures by disturbing some of the fits, and I am of the opinion that it is better to leave them alone at times.]

A.—We, of course, could be wrong, but we feel we are benefiting ourselves by what we do.

Q.—Don't you keep a record of the work you do on these quarterly inspections, so you can go through it and analyze it so you can extend some of this work and probably make it six or nine months on some jobs?

A.—We have made some changes in this program from time to time as experience indicated that it could be safely done.

[Remarks by questioner—We use a similar form, our Form 97-A, but we check those things with our mechanical engineer and sometimes we find we can run a particular job considerably longer and there is no point in taking down that particular part for inspection.]

A.—When you have an assembly that is working all right and you can be assured it will run without taking it down, then it is of course advisable not to disturb it. We go over it all but we do not take our valve motion down, other than eccentric rods. We keep records on all parts and the foreman can pretty nearly tell in advance whether he will need any bushings for a particular engine, but we don't tear the valve motion down. We have a form and every man who works on that particular engine has to sign it when he gets through.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Water Flow Through Globe Valves

Q.—When placing a globe valve in a water-pressure line is the quantity of water passing through the pipe curtailed to any extent? Are not most commercial globe valves designed to give a flow equivalent to the pipe size?—R. E. M.

A.—The discharge of water through globe valves under a given flow pressure depends primarily upon the type of valve considered. The Crane Company has conducted tests on various types of globe valves in sizes up to and including 2½ in. and has determined that the flow through a globe valve is, roughly, one-half of the flow through a short pipe of the same size.

Removing Grates from Locomotives to Be Stored

Q.—When storing a locomotive for a considerable period of time, should the grates be removed?—R. D. K.

A.—It is not necessary to remove the grates from the locomotive for the period during which it is stored. However, it is good practice, on locomotives having grates on which the grate bars are supported on side frames fastened to the side sheets, to remove the grates prior to placing the locomotive in storage. The firebox side sheets behind the side frames should be thoroughly cleaned by sand blasting and a rust-preventative paint applied to this surface to reduce the possibility of the sheets corroding while the locomotive is in storage.

Applying Boiler Studs

Q.—Is it necessary to remove and reapply all studs in a boiler backhead when applying a new set of staybolts using welded type sleeves? In applying boiler studs to the shell of a boiler, should the stud be screwed in the entire thickness of the plate or is a depth equal to the diameter of the stud sufficient?—J. E. B.

A.—It is good practice to renew all studs in the backhead within a radius of six inches of a newly welded staybolt sleeve or staybolt hole, or a stud hole that has had the staybolt or study removed by using the acetylene torch to assure against leaky studs caused by the expansion and contraction of the boiler plate in the area around the staybolt or stud holes being welded or burned.

Boiler studs in the shell of a boiler should be applied so that they extend through the thickness of the sheet or at least flush with the inside of the sheet. To insure that boiler studs enter the sheet a sufficient distance, the tapped hole in the sheet should be gauged so that not less than one thread nor more than three full threads remain outside of the sheet after the stud is screwed in.

Comparative Corrosion Resistance of Boiler Tubes

Q.—Do hot-drawn boiler tubes have a greater resistance to corrosion than cold-drawn tubes?—F. K. R.

A.—As far as practical experience is concerned there is no appreciable difference in the resistance to corrosion of hot-finished or cold-drawn tubes. What difference there is seems to favor the hot-finished tubes. The department of metallurgy and research of a large manufacturer of boiler tubes has checked several investigations and references on the matter of the relative corrosion of hot-finished and cold-drawn tubing and has found that while there may be some evidence that the hot-finished tubing corrodes less than the cold-drawn, the difference between the two is not very great, although it is sufficient for them to be inclined to favor the hot-finished tubing in this connection.

Locating Staybolts Around Stoker Tubes

Q.—On our locomotives equipped with Duplex Stokers, the boiler has two 12-in. diameter stoker tubes in the back head for the stoker distributors. These stoker tubes pass through the back head and firedoor sheets and are welded in place. A question has been raised as to the correct location of the staybolts surrounding the stoker tubes, i.e., the distance from the outside of the stoker tube to the staybolts. Should this distance be limited to one-half of the maximum staybolt pitch of the flat plate?—K. J. F.

A.—The A.S.M.E. Code for the construction of Power Boilers give the following rules for firedoor holes which would also be applicable to the stoker tubes outlined in the question.

Rule 186 (d)

Fusion welding may be used in the fabrication of door holes; provided the sheets are stayed around the opening in accordance with the following:

(1) If both sheets are flanged, the distance from the point of tangency of the flanges and their respective sheets to be the center line of the staybolts shall not exceed the permissible pitch as specified in Par. P-199.

(2) If either or both sheets are not flanged, the distance from the root of any weld to the center line of the staybolts does not exceed one half the permissible pitch as specified in Par. P-199.

The fit-up of the several parts of a fusion-welded door opening shall be such that the maximum gap between the two plates to be joined by welding shall not exceed ⅛ in.

Rule 199 (a)

Beveling Sheets Preparatory to Welding

Q.—In preparing sheets for welding it has been our practice to bevel the edge of the plates either by chipping or machining. Is it satisfactory in applying firebox sheet patches to use sheets having the edges beveled with an acetylene torch?—F. M. I.

A.—Several extended investigations have been made to determine whether there is any difference in the physical properties of a welded joint made with the edges beveled with an oxy-acetylene torch. The net result was evidence that with the reducing atmospheres that are commonly developed in fusion welds applied with the modern improved processes, the flame-cut edges tend to give a somewhat improved condition in the deposited metal as far as porosity and slag inclusions are concerned. As a result of the published reports on these investigations, various code-making bodies have removed all restrictions pertaining to welding on edges or surfaces that have been prepared by flame-cutting, provided the carbon content of the steel does not exceed 0.35 percent. In general, flame-cutting is considered beneficial as compared with other methods of preparing plate edges for welding.

Effect of Tube Length On Steaming Qualities

Q.—What effect does the length of the tubes of a locomotive boiler have on the steaming qualities of the locomotive? Are long or short tubes the most advantageous?—R. E. K.

A.—A locomotive boiler having short tubes will give a greater evaporation per foot of tube than a boiler having long tubes, but the long-tube boiler will have a greater evaporation due to the fact that the longer tubes give additional heating surface even though the evaporation per foot of tube is less. A boiler having short tubes, while giving a greater exaporation per foot of tube, is not as efficient as a long-tube boiler because the hot gasses pass through the short tube more rapidly than through the long tube boiler. Thus the smokebox temperature of the short-tube boiler is much higher than that of a long-tube boiler, indicating that much of the heat that could have been used for evaporation is passing out through the smokestack.

However, increasing the length of the tube does not add proportionally to the steaming qualities of the boiler. The following table from *The Steam Locomotive* by R. P. Johnson gives the additional heat absorbed by lengthening boiler tubes.

Additional Heat Absorbed by Lengthening Boiler Tubes

Item	In B.T.U. per hour	Heat Taken Up As a percentage of heat in coal fired	Heat Taken Up As a percentage of heat taken up by 19-ft. flues
Heat taken up by firebox	29,050,000	28.0	43.0
Heat taken up by 19-ft. flues	38,220,000	37.0	57.0
Total heat taken up	67,270,000	65.0	100.0
Additional heat taken up if flues are lengthened—			
from 19 to 20 ft.	40,000	0.39	0.60
from 20 to 21 ft.	23,000	0.22	0.35
from 21 to 22 ft.	23,000	0.22	0.35
from 22 to 23 ft.	19,000	0.18	0.28
from 23 to 24 ft.	19,000	0.18	0.28
from 24 to 25 ft.	12,000	0.11	0.18
Additional heat taken up if flues are lengthened from 19 to 25 ft.	136,000	1.3	2.04

Welding Restrictions

Q.—Why is it that we are allowed to weld all over the firebox of our locomotive boiler, including the seams, staybolts, patches, syphons, etc., yet welding is strictly prohibited on the shell of the same boiler?—F. E. K.

A.—Welding is permitted on the firebox of a locomotive boiler where the strength of the structure is not dependent on the strength of the weld. Fireboxes are so constructed that practically the entire load or pressure on the plates is carried by the staybolts, and for this reason the welding of seams, patches, etc., is permitted. On the shell of the boiler the load or pressure is carried entirely by the plate, and therefore anything that effects the strength of the plate also effects the pressure that can be carried by the boiler.

Welding is prohibited because no definite value can be given to the strength of the welds unless they are

made in strict accordance with the welding procedure given in Section 9 of the A.S.M.E. Boiler Code Rules, the welds X-rayed, and the boiler stress-relieved in a furnace of sufficient size to take the boiler as a unit. As it is practically impossible to make welds on boilers that will conform to the requirements of the A.S.M.E. Code in Railroad Shops and Engine Houses, welding on the shells of locomotive boilers is prohibited.

Air Brake Questions and Answers

The 24-RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

479—Q.—Describe the main reservoirs.

A.—Main reservoirs are used to store and cool the compressed air furnished by the air compressor and to collect moisture. Each reservoir is provided with a drain cock by means of which all residue may be drawn off at frequent intervals, as water or oil collecting will soon materially decrease the air storage capacity.

480—Q.—How are these reservoirs identified?

A.—All main reservoirs are numbered serially before leaving the factory and a certificate is furnished, setting forth in detail the design, material, construction and test with a detachable portion covering the specific information which the Interstate Commerce Commission now requires all interstate carriers to file.

481—Q.—What type reservoirs are recommended and why?

A.—Enameled reservoirs are recommended on account of their durability and protection against corrosion, oxidation, etc. These reservoirs are enameled by a special process both inside and out.

482—Q.—How should the main reservoir capacity be arranged?

A.—It is recommended that the main reservoir capacity be diveded into two or more reservoirs of such suitable dimensions, so located and connected by piping, as to give the greatest possible radiating surface for cooling the air to atmospheric temperature, and consequently inducing the precipitation of moisture before the air is used in the brake system.

483—Q.—Does it make any difference as to the location of main reservoirs?

A.—Yes, they should be located in as cool a position as possible.

484—Q.—Describe the flanged fittings for main reservoirs.

A.—As shown in the sectional view (Fig. 4), a forged steel flange is set into and welded to the head, and the reinforced fitting with copper gasket applied to it by four cap screws. The welded flange is suitable for Wabcotite flanged fittings for 2 in., 1½ in., 1¼ in. or 1 in. iron pipe. The Wabcotite flanged fittings are available in both straight and elbow types.

485—Q.—Describe the combined equalizing and reduction limiting reservoirs.

A.—These two reservoirs are combined in one welded tank. The larger volume is the equalizing reservoir which is, in effect, an enlargement of the chamber above the equalizing piston of the automatic brake valve, providing an operating volume sufficient to stabilize the equalizing piston against brake pipe volume underneath. The smaller volume is the reduction limiting reservoir into which the equalizing reservoir equalizes at the beginning of a brake application from *first service* position of the brake valve and also during a safety control or train control application.

486—Q.—Describe the pipe connections for the combined reservoirs.

A.—The pipe connections, *5* for the equalizing reservoir and *22* for the reduction limiting reservoir, are plainly marked and are connected to marked ⅜-in. pipe connections (*5* and *24*) on the brake valve pedestal.

487—Q.—Describe the functioning of the E-7-B safety valve—Fig. 6.

A.—When the pressure in cavity *a* under valve *4* is sufficient to overcome the pressure exerted by the tension of spring *6*, valve *4* is raised from its seat. The air pressure then is exerted in cavity *b* over the full diameter of the valve *4* which provides sufficient extra force to continue the valve moving against spring *6*. Air then flows past the valve and to the atmosphere through port *c*. While in the open position, the upper end of valve *4* closed off communication from chamber *g* to the chamber *e* so that air cannot flow through bypass port *d* to the chamber *e*. As the pressure below valve *4* decreases, the tension of spring *6* forces the valve downwardly. This restricts the opening of port *c* and at one stage in the movement opens chamber *a* to chamber *g* and to chamber *c*.

488—Q.—What adjustment can be made to assist the spring 6 in closing valve 4 to its seat?

A.—Although the ports *f* are open to the atmosphere, they may be so restricted by the ring *8* as to allow the pressure to build up rapidly in chamber *e*, assisting the spring *6* in closing the valve *4* on its seat.

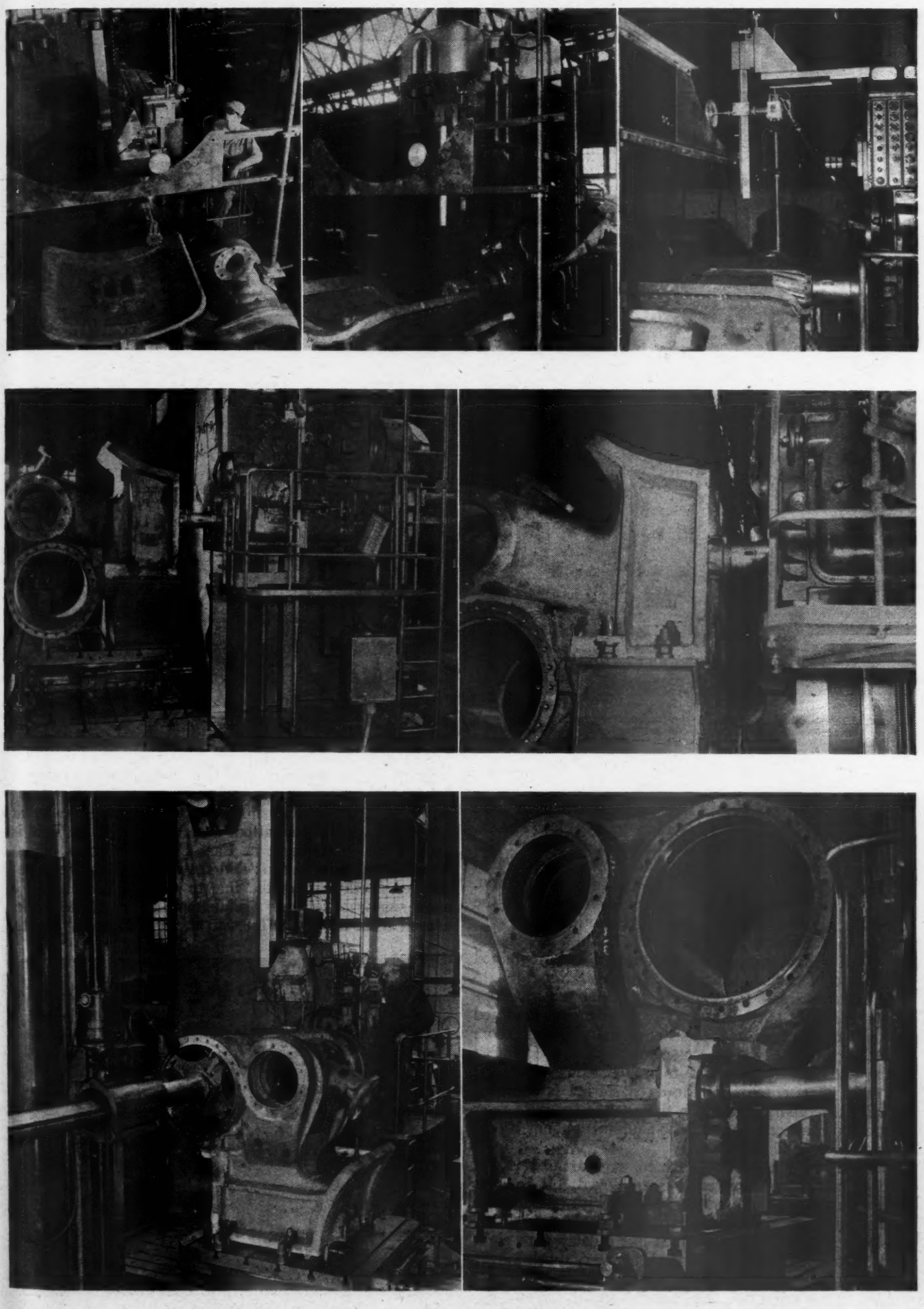
Machining Locomotive Cylinders at L. & N. Shop

The illustrations opposite show operations in finishing steam locomotive cylinder castings at the So. Louisville, Ky., shops of the Louisville & Nashville, on a new Giddings & Lewis No. 560 table-type horizontal boring, milling and drilling machine, equipped with a 6-in. boring bar and a Universal Duplicator.

Prior to the purchase of this machine, it was necessary in machining locomotive cylinders to plane the frame fits, splice fits and saddle radius on one machine, and bore the cylinders and valve chambers and slot the frame-toe fits on other machines. With the G. & L. machine, locomotive cylinders are finished completely on a single machine in about 40 per cent of the time formerly required. This is made possible due to the high speed range and horsepower available, which permits the fullest use of carbide tool cutters in the boring of cylinders and valve chambers and the use of carbide milling cutters in facing the frame fits and saddle-splice fits.

In addition to machining locomotive cylinders, many other forgings and castings can be handled on this machine that were formerly machined on planers and slotters, such as frame splices, multiple-bearing crossheads, die blanks, exhaust-stand faces, facing counter-balances on mounted driving wheels, etc., with at least a 50 per cent decrease in man hours over the previous methods employed.

Another interesting job which is made easy on the G. & L. machine is the machining of locomotive steam pipes. Only one setting is required to face both ends as by turning the rotary table both joints can be faced square with each other.



Various operations in finishing steam locomotive cylinders on a G. & L. No. 560 horizontal boring and milling machine at the South Louisville shops of the L. & N.

Locomotive cab showing the hand set, the loudspeaker over the engineman's seat and the motor-generator set (upper right)

New Haven Tests Sperry Radio

Fixed unit in passenger station is operated through 2-mile wire line from hump office to communicate with mobile locomotive unit

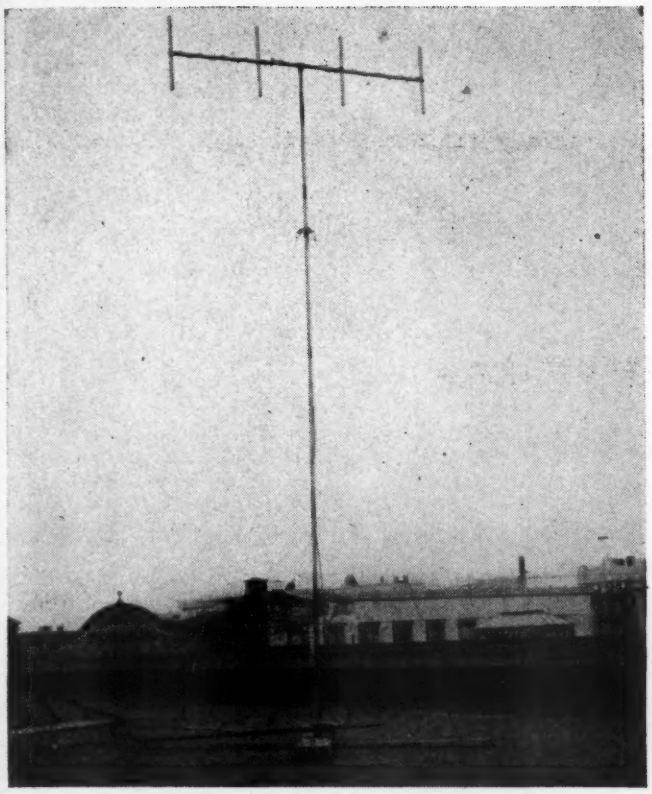
Two units of the Sperry Gyroscope Company railroad radio RCU #1 have been installed on the New Haven, at Hartford, Conn., for use in hump yard and general yard and terminal operations. One unit is installed in a switch engine. The other unit serves as a fixed station, and is located in the telephone equipment room at the railroad's Hartford, Conn., passenger station.

Both installations are temporary. They are being employed to demonstrate the advantages to be obtained by the use of radio during switching operations and to permit the railroad to evaluate the Sperry Gyroscope Company radio. The transmitter-receiver unit at the fixed station is on the floor in the corner of the telephone room near the coil rack. The accessories, with the exception of the antenna, are screwed to a board lashed to the coil rack. The antenna of the fixed station is mounted on a 22-ft. temporary mast on the roof of the passenger station and connected to the radio equipment about 100 ft. away with coaxial cable.

Because the area to be covered at Hartford is not circular, a directional antenna is employed. It consists of four vertical di-poles which interact with one another to produce a radiation pattern of the desired qualities. This pattern is shaped very much like a daisy with eight petals, two of whose opposite petals are very much longer than any of the others. These petals are called "lobes"; the two long petals are called the "main lobes," and the others are the "side lobes." The antenna is oriented so that the two main lobes lie in the same line as the main-line tracks through Hartford. The side lobes then lie by coincidence along the side tracks to the limits of the terminal area.

The main line runs through Hartford from north to south, and the southern terminal limit is at Newington Junction, a little more than 5 miles from the passenger station. The northern limit is about 4 miles away at the end of the classification yard. The eastern limit is beyond the enginehouse at East Hartford, Conn., about 4 miles from the station; and the other limits are about 2 miles northwest on the line to Griffin, Conn., and 3 miles southeast towards Middletown, Conn. Side tracks extend from all of the lines to various shippers' plants.

The transmitter-receiver is mounted on the left side of the locomotive under the cab

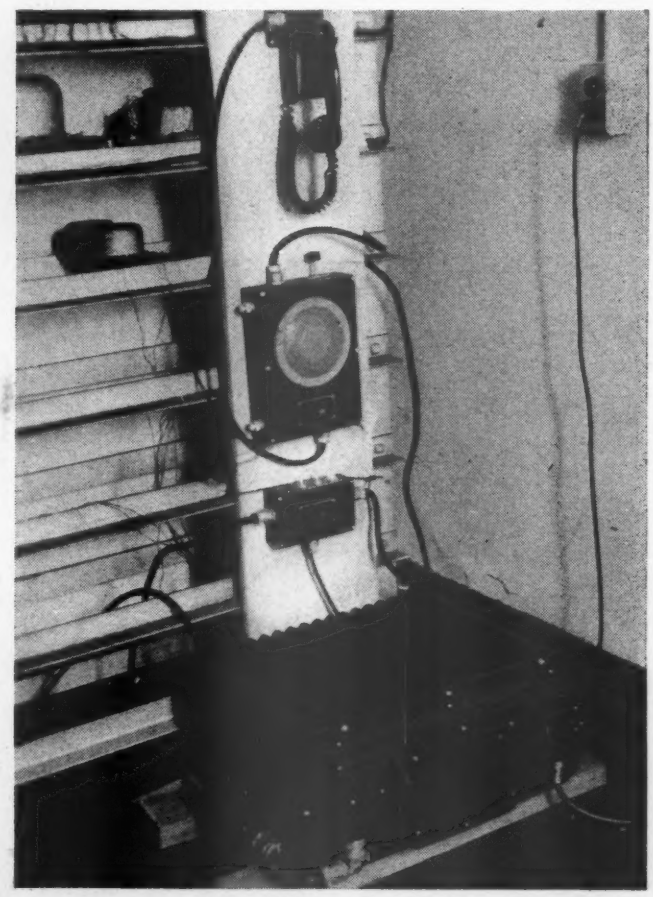


The antenna at the station produces a radiation pattern which conforms to the track layout in the terminal area

The fixed station can be operated from either of two points. The least used talking station is in the telephone room. This is used chiefly for testing and, on rare occasions, for demonstration. The most used operating position is at the general yardmaster's office in the classification yard, 2½ miles from the passenger station. This office is not far from the hump; and although the remote station is in the office, it is used considerably by the hump conductor.

The remote station consists of a loudspeaker and a push-to-talk handset. The talking battery is supplied locally from No. 6 dry cells. Although 2 cable pairs are employed to connect the talking station to the fixed station, only one pair is necessary. The second pair is used for the pilot lights on the speaker; but little attention is paid to these, and they are unnecessary to the satisfactory operation of the remote position. Western Electric type 76A repeating coils are employed to obtain correct impedance matching of the speaker and handset to the cable pair and to the transmitter-receiver unit at the passenger station. Observance of standard telephone impedance matching practices assures minimum losses between the fixed station and the remote point, and more than adequate loudspeaker volume is obtained at the yardmaster's office without using amplifiers. The functions of the radio unit at the passenger station are controlled by the push-to-talk button on the handset. This is connected to the unit by simplexing the cable pair used for talking.

The unit in the switch engine was at first installed under the fireman's seat in the cab. This location interfered with the space normally used by the fireman for storing his clothes, so, after about 3 weeks in this location, it was moved outside to a position just beneath the cab. The former location proved the radio's imperviousness to water, because it was frequently subjected to a high-

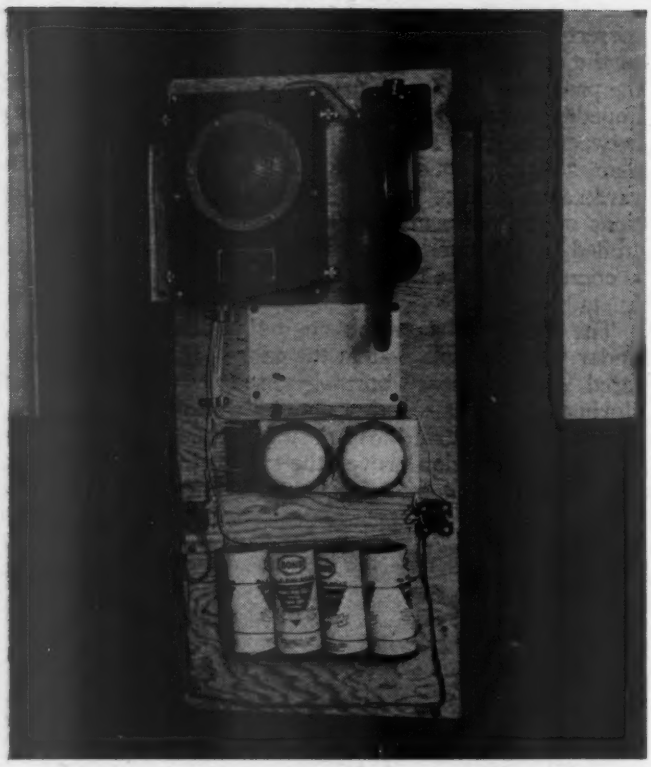


The fixed sending and receiving unit located in the railroad station

pressure stream of water from the "wash-down" hose without being affected. Another proof of its suitability to railroad use was brought out when the unit was moved. The cab location subjected the radio to air containing large amounts of coal dust, and when the filter was inspected at the time of the move, it was found to be coated with a thick layer of dust. None, however, was found to be in the radio chassis.

The loudspeaker is mounted above the engineman's head, and the handset-hanger is bolted to the cab wall in a location near his hand. The quality and volume of speech from the speaker is more than adequate and can be understood by the conductor when he is outside of the cab on the ground. It easily overrides the noise level in the cab when the engine is operating at full load. Likewise, neither the noise of the air brakes nor the

The quarter-wave folded antenna and ground plane on the locomotive tender



The telephone connection at the humpyard office operated by dry batteries and mounted temporarily on a door

fire door opener interrupts radio communications.

A control box is also installed in the cab, but its inclusion has been found to be inadvisable because the radio has been turned off by the engine crew when they thought it was not needed. The radio is designed for continuous duty, and therefore, can be left running as long as there is steam in the boiler.

The radio obtains power from the headlight generator, which furnishes 32 volts d.c., and this is converted to 117-volt a.c. power by a "Kato" inverter. This unit has a 300-watt capacity and is more than adequate for supplying power to the radio. The operation of the radio does not overload the headlight generator.

The antenna for the switch engine is mounted on the tender because height limitations imposed by overpasses do not permit its installation on the roof of the cab. A quarter-wave folded antenna is employed which is only a little more than 14 inches long. In order to obtain omni-directional characteristics, the quarter-wave antenna should be mounted on a flat ground plane of at least a quarter-wave radius with no interfering obstacles within this radius. This condition has been met by installing such a plate aft of the coal hopper, raised up above obstructions on the top of the water tank. No tests have been made to determine the pattern obtained from the antenna, but the results have shown that experimentation was not necessary. Operation anywhere in the Hartford area is entirely satisfactory.

The only feature favorable to the radio installation at Hartford is the central location of the passenger station. It is, however, located in a hollow, and the tracks at this point are elevated. The antenna, although mounted on a 22-ft. mast on the station roof, is only about 50 ft. above the tracks. The station is surrounded by tall buildings which tend to deflect the radio waves, as do the rolling hills which surround Hartford. None of these features is favorable to very high frequency radio transmission, but communication between the fixed station and the switch engine anywhere in the terminal area is highly satisfactory. This is due chiefly to the highly sensitive receiver that is employed. Diffusion and diffraction caused by the hills and buildings cause the signal to be very weak, requiring a high degree of sensitivity in the receiver. This is exemplified by the weak signal (indicated by the fluttery operation of the carrier-operated lights), which exists relatively near to the station. As the engine gets into more open areas, the signal increases.

The operation of the equipment has proved eminently satisfactory. Its use has, in many ways, saved operating time within the terminal area, and it has been particularly advantageous in improving hump operation in foggy weather when the hump signals could not be seen by the engineman.

Applications of the Carryphone

The carryphone, which was described in the December, 1946, issue of *Railway Mechanical Engineer*, is a portable, inductive-type communication device, developed jointly by the Pennsylvania and the Union Switch & Signal Company. The following excerpt from a paper on "Inductive Train Communication Systems," delivered by G. W. Baughman, Chief Engineer, Union Switch & Signal Company, November 21, 1946, before the Communications Section of the A. A. R., adds some interesting information on its development and applications.

"For a long time it was considered a practical impossibility to develop a portable transmitter and receiver for the inductive train communication systems which would be comparable in any way with the walkie-talkie. Continued and intensive development on this problem, however, has resulted in what is known as a "carryphone" which appears to be entirely practical, and is to the inductive train communication system what the walkie-talkie is to the radio train communication systems. There are now two carryphones in regular service on the Belvidere branch of the Pennsylvania. These carryphones are quite popular with the members of the freight train crews who use them whenever unusual conditions arise. We quote from one of the early reports from a field engineer on this installation, explaining why these carryphones are becoming popular:

"On Monday, July 29, the BG-1 with 112 cars developed a hot box 40 cars from the rear of the train, when the train was between Stockton and Lambertville. Conductor Hoag took the carryphone up the train with him to investigate the trouble. He transmitted the number of the hot box car to Frenchtown and arranged for a set off, and told the engineer to go ahead. In starting the train, a drawhead was pulled 19 cars from the hot box car, and the train was stopped. Mr. Hoag immediately advised Frenchtown of the situation, got instructions for setting the car out, set it out, coupled up and took off, all in less time than it would have taken him to walk back to the cabin car from the hot box car, and make his report."

One of the most recent applications for the carryphone is in passenger train operation where tests indicate that it will be feasible to carry on conversations from any of the cars in a passenger train to the locomotive. With the two-channel equipment in the locomotive, it is possible to make an arrangement whereby conversations may be conducted between the carryphone in any car of a passenger train and a wayside station. The main advantage of the carryphone in this application is that no line wires are required throughout the length of the train, and the carryphone may be in any one of the cars.

Welding Equipment for Thawing Frozen Pipes

By R. F. Wyer*

THE use of electric welding equipment to thaw frozen water pipes has been practiced successfully by a number of plant owners during the past few winters. Welding equipment offers advantages over other electrical means because it is self-regulating and can be accurately controlled. No special equipment is necessary for doing this work other than reliable pipe clamps for making firm electrical connections. Strap-type clamps of copper, having ample section to carry several hundred amperes, are desirable. C-clamps may be used to clamp cable terminals directly to the pipe where necessary. A file, rasp, or abrasive cloth may be used to remove zinc oxide, rust, paint, and grease to assure a good electrical contact.

Cable should never be wrapped around the pipe as a connection, since it is practically certain to loosen, and may cause hazardous sparking. Ordinary pipe wrenches are required for disconnecting piping. A portable voltmeter is useful for checking voltage drops and determining the continuity of circuits.

The connections to the welding generator are made in the ordinary way with the work lead and electrode lead both connected to the pipe on opposite ends of the frozen section so that the heat generated in the pipe wall by the passage of current will thaw the ice in the pipe. The method of getting at the pipe will vary in almost every case, but for economy, it is desirable to get as close to the frozen portion as is feasible without excessive digging in frozen ground. It is desirable to set the machine at the lowest current output adjustment at the beginning of a thawing interval to permit checking connections with the least liklihood of flashing.

While the proper current for thawing pipes has been established as between 200 and 500 amperes, the time needed to complete the job varies greatly according to the size, length, kind, and location of the pipe, condition of the surrounding soil, extent of the freeze, and temperature of the air. Tables I and II will help determine the various factors involved.

While the resistances given are for direct current, the reactance is so small that it can ordinarily be neglected when cables are not coiled. There are so many other variables in a given case that the voltage necessary to produce the current will be, for all practical purposes, the same for both a.c. and d.c. Table III shows the maximum outputs which can be obtained from the arc welding equipment which would normally be used for pipe-thawing purposes.

Where welding sets are to be operated at less than 80 per cent of their current rating, the operation can be continuous. For example, a 400-amp. d.c. set can be operated continuously at 320 amp. without damage. Likewise, a 500-amp. transformer can be operated at 400 amp. continuously. The sets may be operated at their maximum output for intermittent periods up to 15 minutes if sufficient time is allowed for return to normal temperature.

When using arc welding equipment for thawing purposes, there are a number of precautions which must be observed. If a good, low-resistance joint is not obtained between the copper cable and water pipe, excessive heat will be generated at the connection. If the current is allowed to form an arc at this point, it may damage the pipe.

Care should be taken to select the correct amount of current where there is known to be lead pipe, because it will stand less current than iron. The pipes should be disconnected from the building piping before the wiring so that the current has only one path in which to travel—through the section which is frozen. If this is not done, where other devices are grounded to the water pipes the ground wires may burn out and cause a fire, since the grounding connections will be raised above earth potential.

In using single-operator d.c. sets, two points should be noted. The low load voltage will result in the possibility of unusually heavy currents on the lower taps. Since these taps are designed to carry the low currents which will be drawn at normal operating voltages, the result may be to overheat portions of the series field. This can be avoided by setting the units on the highest tap and lowest open-circuit voltage which will give the desired current.

In addition, the low load voltage should be considered in making an estimate of the current setting required. Since load voltages in the neighborhood of 5 or 6 volts will often be encountered, the output current on any setting will be as much as 1½ times the current which would be drawn by a welding arc. With transformers, however, the current drawn by the load will be very nearly that indicated on the nameplate.

As a final precaution, the resistance of the joints in the pipe should be determined. If the joints are insulated by rust or pipe dope, a spark may start a fire.

Table I

Pipe Diameter in Inches	Recommended Amperes	Approx. Minutes to Thaw	Recommended Cable Size	Resistance per 100 ft. Cable
¼	75	15	No. 6	.0395
½	125	20	No. 2	.0156
¾	200	20	No. 0	.00984
1	250	30	No. 00	.00780
1½	300	30	No. 000	.00619
2	350	40	No. 0000	.00491
4	600	75	400,000 c.m.	.00270
6	800	120	600,000 c.m.	.00180

Table II

Ohm Resistance per 100 Ft. Standard Pipes

Pipe Diameter	Wrought Iron	Steel	Copper Tubing	Lead	Cast Iron Class A
½	.026	.0198	.00824	.0234	
¾	.0202	.01485	.00445	.01371	
1	.0138	.0100	.0034	.00984	
1½	.00842	.00618	.00208	.0064	
2	.00625	.0046	.00133	.0053	
4					.0092
6					.006

Table III

Equipment	10 Volts	20 Volts	30 Volts	40 Volts
300-amp., a.c. welders	500 amp.	450 amp.	400 amp.	375 amp.
500-amp., a.c. welders	800 amp.	750 amp.	700 amp.	625 amp.
300-amp., d.c. welders	650 amp.	600 amp.	500 amp.	400 amp.
400-amp., d.c. welders	800 amp.	750 amp.	700 amp.	600 amp.
600-amp., d.c. welders	1,200 amp.	1,000 amp.	900 amp.	700 amp.

* Electric Welding Division, General Electric Company, Schenectady 5, N. Y.

Amplidyne Inverters for

Pennsylvania Passenger Cars

Three-phase power system will carry all loads except compressor motor—Electro-mechanical food refrigerators will be used on dining cars

DURING March 1945, the Pennsylvania Railroad turned out of its Altoona Works coach No. 3941, equipped with experimental continuous fluorescent lighting, located under the bag racks, on both sides of the car. The power supply for this lighting system was an adaptation of a power system developed during the war for fluorescent lighting on aircraft, and consisted of a rotating type inverted converter, which converted nominal 32-volt direct current battery energy to three-phase, variable voltage-variable frequency alternating current.

The variable voltage-variable frequency system of fluorescent lighting is practical because of the large amount of reactance in the ballasts and because of the characteristics of the lamps themselves. When the frequency and voltage applied to a pure inductance are varied in direct proportion to each other, the current through the inductance will remain constant. In addition to inductance, the actual lamp circuit contains resistance and the arc of the lamp, so that there is some departure from a constant current circuit, but the installation has proven successful. The frequency of the inverter varies from approximately 44 cycles with 25 volts at the battery to 69 cycles with 45 volts at the battery.

In laying its plans for post-war cars, the Pennsylvania decided that fluorescent lighting should be employed and that, as a source of alternating current was to be provided to operate the fluorescent lighting system, the alternating current power supply should be of sufficient capacity to operate all motors except the Freon compressor motor. Due to its higher efficiency, the inverted converter was preferred to the motor-alternator sets then available. The problem was to stabilize the frequency output of the inverter used on coach No. 3941 to make it adaptable for operating three-phase and single-phase induction motors. This was accomplished by mounting an amplidyne on the same shaft as the inverter armature so as to maintain substantially constant d. c. voltage input to the inverter regardless of the battery voltage.

The amplidyne is connected in series with the inverter and bucks or boosts the voltage supplied by the axle generator or battery to maintain approximately constant a. c. voltage and frequency on the output side of the inverter. An amplidyne is used for three principal reasons:

1—To get high speed response in case an induction motor is started when the set is loaded. The amplidyne performs as an exceedingly fast regulator and permits the starting of motors as large as one horsepower on a 5-kilowatt set without noticeable effect on fluorescent lamps operated from the same set.

2—To eliminate the losses in the field. The amplidyne control field takes about one-half watt to one watt.

3—To permit the use of a static regulator without moving parts.

It was also decided to install nominal 110-volt batteries on the new cars and the General Electric Company was given an order to supply "Amplidyne Booster Inverters" of 5-kw. capacity to convert direct-current battery voltage ranging from 96 to 160 volts to three-phase alternating current at 230 volts for the 90 new cars to be built by the Pennsylvania at its Altoona Works. Subsequent orders for new cars placed with the various car builders have specified similar a. c. power supply systems, except that inverters of 6.4-kw. capacity have been specified for the kitchen-dormitory cars of twin-unit diners and for single-unit diners to furnish the necessary capacity to operate a. c. electro-mechanical refrigerators. At the time of this writing, the first of the 5-kw. machines has been built and tested, and under conditions of no load to full load, the frequency variation is within 58 to 62 cycles with d. c. battery voltage of 105 to 160, and within 57 to 59 cycles with d. .c voltage of 96 to 105, while the a. c. voltage is within plus or minus 1 per cent.

The 5-kw. inverter, Fig. 1, is approximately 45⅜ in. long by 16 in. in diameter, and weighs about 800 lb., while the 6.4 kw. inverter is approximately 49 in. long by 16 in. in diameter, and weighs about 900 lb. The inverters start through one step of resistance under the control of an auxiliary contact on the circuit breaker or switch which connects the load to the alternating-current output, so that, if there is no demand for alternating-current on the car (all switches and breakers open), the starter opens and shuts down the inverter. The starting

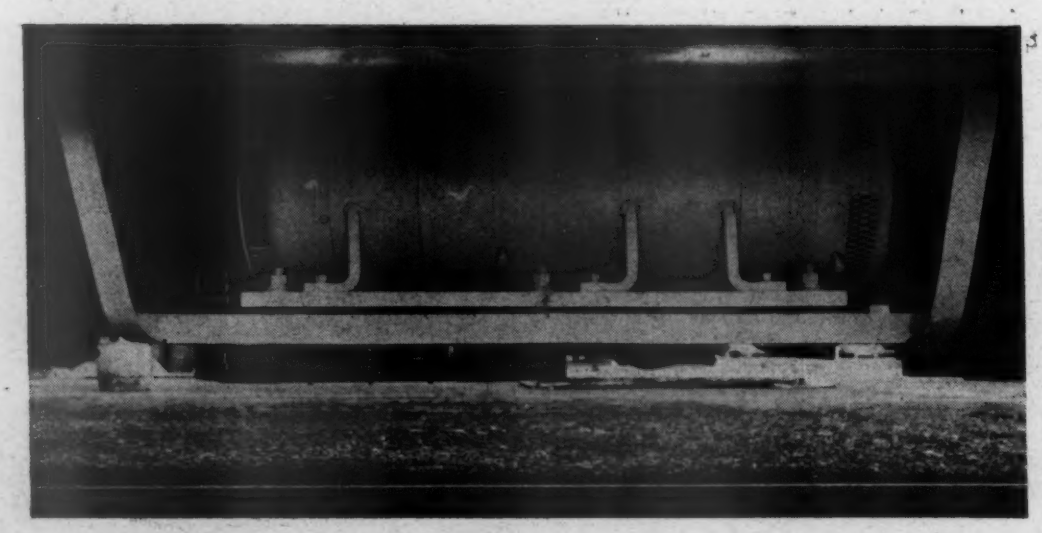


Fig. 1—A 5-kw. Amplidyne Booster Inverter mounted under a car

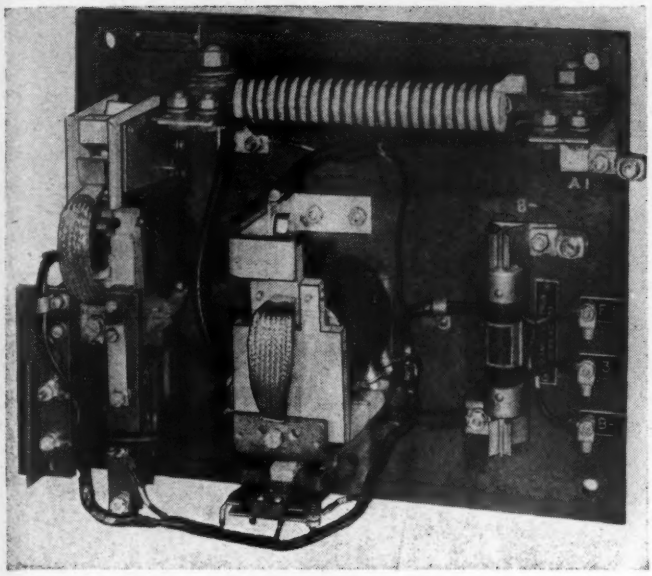


Fig. 2—Starting Panel

panel is shown in Fig. 2, and is approximately 16 in. wide by 13 in. high by 7⅝ in. deep. The static regulator, shown in Fig. 3, with cover removed, is approximately 16 in. wide by 13 in. high by 7 11/16 in. deep, and can be located conveniently in the car. There is another design of inverter, for operation in a vertical position, which can be installed in a locker inside the car.

As applied to the Pennsylvania cars, the amplidyne booster inverter supplies alternating current for the operation of all fluorescent lighting, air-conditioning main blower motor, condenser fan motor, exhaust and booster fan motors, electro-mechanical drinking water coolers, electro-mechanical refrigerators, radio and public address systems and electric razor outlets. Incandescent lighting is also supplied from the inverter. The only incandescent lighting supplied by direct current is for an emergency in the event of a failure of the inverter. The Freon compressor motor is operated from non-regulated, direct-current voltage.

When providing equivalent illumination levels, the overall efficiency of a car equipped with the amplidyne booster inverter will be as good or better than a car equipped with either a direct-current system, in which the main blower motor, incandescent lighting, exhaust fans, etc., are operated on regulated voltage through lamp regulators, or a system in which the main blower motor, exhaust fans, etc., are operated on regulated voltage through lamp regulators and fluorescent lighting is supplied from a motor-alternator. In addition, all brush and commutator maintenance on motors located in relatively inaccessible places is eliminated, while that brush and commutator maintenance which is necessary is confined to the inverter and Freon compressor motor, both of which are located under the car and readily accessible. This should reduce the total overall maintenance required on the various motors and result in improved performance.

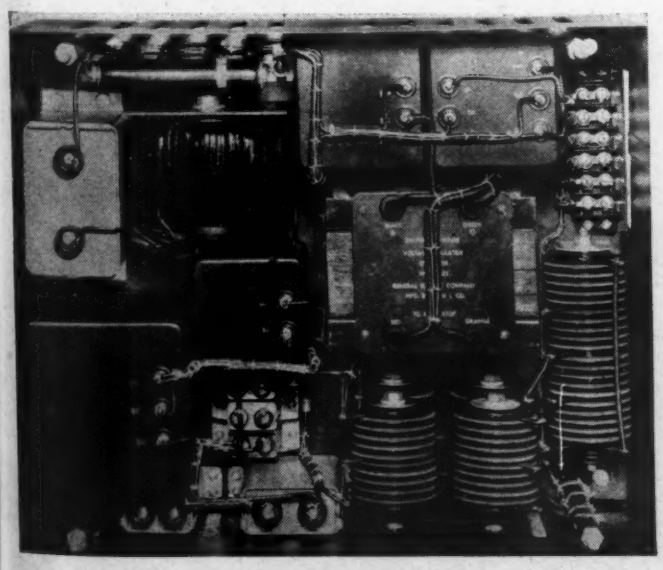


Fig. 3—Static Regulator with cover removed

The total weight of electrical apparatus in the new cars with 110-volt direct-current systems and amplidyne booster inverters is somewhat heavier than that for corresponding apparatus in cars with 32-volt direct-current systems and motor-alternators, as shown in the following tabulation of weights of apparatus in coaches equipped with nickel-iron batteries:

Weights of Electrical Equipment

	110-volt direct current with amplidyne booster inverter	32-volt Direct current system with motor-alternators
Battery	4,900 lb.	3,600 lb.
Conduit and wiring	2,250 lb.	3,250 lb.
Axle generator, incl. controls (20-kw.)	.....	1,315 lb.
Axle motor-generator, incl. controls (25-kw.)	1,980 lb.	.....
Freon compressor motor	575 lb.	590 lb.
Condenser fan motor	87 lb.	.....
Evaporator blower motor	87 lb.	135 lb.
Exhaust fans (3)	134 lb.	(2) 35 lb.
Booster fans (2)	228 lb.	.....
Amplidyne booster inverter and regulator	890 lb.	.....
Motor—alternator and control	.....	550 lb.
Lamp regulators	.....	136 lb.
Air-conditioning controls	91 lb.	136 lb.
Other items	Same for both systems	
Total	11,222 lb.	9,747 lb.

This increased weight, however, is due, in a major part, to differences in parts of the apparatus which do not make them readily comparable as:

1—The use of a larger battery. The various manufacturers' batteries in the 110-volt d. c. system have capacities of approximately 51 to 58 kw.-hr. at the 8-hr. discharge rate, whereas the batteries in the 32-volt d. c. system have capacities of about 39 to 40 kw.-hr. at the 8-hr. discharge rate. Larger capacity batteries are used in these new cars to not only handle the increased electrical loads but to provide for longer periods of operation from the battery. The batteries used on previously built Pennsylvania coaches equipped with electro-mechanical air-conditioning will carry the maximum load for about 1.75 hours, whereas the batteries being applied to the present order for new coaches will carry the maximum load for about 2 to 2.3 hours, depending upon the various manufacturers' types used.

2—The use of an axle motor-generator set in the 110-volt d. c. system, whereas a straight axle generator is used with the 32-volt d. c. system.

3—The use of recirculated and exhaust air ducts located in the baggage racks in the new 110-volt d. c. coaches, requiring additional exhaust and booster fans over that required in the 32-volt d. c. coaches.

If batteries of equal capacity, comparable generators, and the same recirculated air and exhaust ducts were used in both cases, the 110-volt d. c. system with amplidyne booster inverter would show a lesser weight than the 32-volt, d. c. system with motor-alternator.

LIGHTING THE WAY CAR

By Walt Wyre

H. H. Carter, master mechanic of the Plains Division of the S. P. & W., was muttering and rumbling like a hungry lion in a cage. He stopped pacing the floor long enough to pick up a letter from the desk, glance at it, and throw it back on the desk. He took another turn around the big desk in the little office, picked up the company telephone and rang the roundhouse office. "See if you can find Sparks. . . . Yeah, Ned Sparks, the electrician. Tell him I want to see him!" Carter slapped the receiver on the hook and sat down to wait for Sparks.

"Did you want to see me?" Sparks asked about ten minutes later.

"Yes. Sit down. What do you know about caboose lighting?"

"Not much." Sparks, not knowing what the master mechanic was driving at, hesitated, waiting for the master mechanic to say more.

"You know, I guess, that the S. P. & W., along with other railroads, has been figuring on electric lighting for cabooses and, incidentally, power for radio communication between the caboose and head end."

"Yes, sir," Sparks nodded.

"Well, different railroads have tried several different types of equipment from windcharger to Diesels with varying success and none of them have proven entirely satisfactory." Carter paused.

Sparks, still not knowing exactly what the conversation was all about, said nothing.

Carter picked up the letter and glared at it a moment. "Well, here's where we come in. The mechanical superintendent has been after Ray McWilliams—you know, the electrical engineer—to get the dope on caboose lighting and recommend a standard for the S. P. & W. Ray, not wanting to get his neck out too far, suggested that we install several different types of equipment and decide which one is best. And," the master mechanic paused again, "they decided to have the equipment installed here at Plainville and tested out on the Plains Division and the Mountain Division out of Sanford."

"But—" Sparks began, but the master mechanic interrupted him.

"Yes, I know you are already behind with your work and haven't got enough electricians already. Well, they are sending us another electrician to help install the caboose lighting equipment and the car foreman will let you have a helper."

"Where will we do the work?" Sparks asked.

"In the car shed. I told Dick Wheeler to let you have room and to fix up a place for you to store material."

Sparks shivered at the thought of working in the car shed, an old barnlike structure that wasn't tight enough to hold hay.

"Oh, yes," the master mechanic picked up the letter he had thrown down on the desk and handed it to Sparks, "read this. It will explain more fully. The other electrician should be in tonight on the Limited. You can start on the job tomorrow. Some of the material is in the storeroom."

Sparks took the letter and went to the electric shop.

While Sparks was reading the letter, Jim Evans, the roundhouse foreman, came in. "Say, Sparks, the switch on the fuel oil pump motor stuck and run about a thousand gallons of oil out on the ground and there's something wrong with the motor on one of the roundhouse heaters. Better see about the switch now and check all of the heater motors and controls first thing tomorrow."

Sparks didn't say anything, just handed the letter to Evans. The foreman read the letter, swore mildly, jerked his derby down hard and started off. "Look at the fuel oil pump motor, anyway," he said as he left the electric shop.

Next morning when Sparks came to work he found a long lanky red-faced man in the electric shop.

"Good morning," Sparks greeted.

" 'Morning,—my name is Rodgers, and don't call me Wilbur, even if it is my first name. Just call me Slats like everybody else does." Rodgers wrapped his long fingers around Sparks' hand. "I'm an electrician," Rodgers added.

"Know anything about caboose lighting?" Sparks asked.

"Not much," Rodgers admitted, "but I don't figure it will be much trouble. I'm a combination man, as they say in the cotton country, I can chop or pick." The lanky electrician grinned at his own joke.

After Sparks had shown Rodgers where to put his things, the two men went to the storeroom. "What have you got around here in the way of caboose lighting equipment?" Sparks asked the storekeeper.

"Well, I don't know. There's a whole stack of electrical equipment back in the corner of the storeroom and a lot of storage batteries in the brick house. Some of the stuff is fairly heavy. Better get the portable crane to handle it if you want to take it out," the storekeepers added.

"Maybe we had better go to the car department and find out where Dick Wheeler wants us to put it."

"Yes, I fixed up a place," the car foreman told Sparks. "I had laborers clean out the old coal shed back of the car shed. There's no floor in it, but there's a pile of grain doors over by the back track you can use."

Sparks and Rodgers walked over and looked at the erstwhile coal house. Aside from being dirty as a coal house, and too small, it was nearly a hundred yards and two tracks away from the car shed.

After some argument, a temporary storeroom was arranged by laying grain doors on the ground in one corner of the car shed. The rest of the day was used up hauling the equipment from the storeroom, uncrating and attempting to classify.

Next morning Sparks and Rodgers met in the electric shop. "What'll we do today?" Rodgers asked.

"Danged if I know"—Sparks scratched his head—"if I knew where to put batteries on a caboose we could start there, but there is no battery box under a caboose and no place to put one that I can see. Guess we'd better ramble down towards the airdrome and see what we can figure out."

When the two electricians were passing the master mechanic's office, one of the clerks opened the office door and told them to come inside a moment.

"How many convenience outlets are you putting in?" the conductor asked

WHEN Sparks and Rodgers entered the office they saw Ray McWilliams talking to the master mechanic. "Am I glad to see you!" Sparks told the electrical engineer. "We were just wondering where to start."

"Here is a print showing the caboose lighting." McWilliams fished the paper out of his brief case. "This just shows wiring from the battery. You will notice it shows rigid conduit but we'll have to use BX for most of the work."

"What about the Diesel set and the other generators?" Sparks asked.

"Well, we will have to figure them out as we go along. We have a Diesel generator, a home lighting plant with a gas carburetor adjusted for propane, and two axle driven generators, one V-belt and one flat belt."

"There are three sets of batteries," Sparks reminded.

"Yes," the electrical engineer nodded, "one caboose will have batteries only. We will arrange for charging them at the caboose track. Guess we might as well go down to the car department and see what we have."

"Guess you fellows might as well start wiring a caboose," the electrical engineer told Sparks and Rodgers. "We'll use batteries on the first one we do."

There was a caboose tied up for repairs to the roof and cupola windows. The car foreman said it would be a couple of days before it was ready to go.

"Where do you plan to put the batteries?" Sparks asked.

"Glad you mentioned that," McWilliams said. I've got to see the roundhouse foreman about getting some

battery boxes made. We plan to put the batteries under one of the bunks. It may be necessary to raise the bunks a little to make room enough. Let's do a little measuring."

"Might be a good idea to have that bunk taken down," the electrical engineer told the car foreman, "and it will be necessary to cut an opening in the side of the caboose and put a screen over it. There'll be an opening in the side of the steel battery box so fumes from the battery can escape."

"Well, Slats, guess we might as well get started," Sparks said.

"Where do we start?" Rodgers wanted to know.

"Guess we might as well run from the battery to the switch in the washroom. If you'll cut a piece of three-quarter conduit to run from the battery to the switch, I'll hang the switch and start from there with BX." Sparks went to get the switch and a roll of BX, leaving Rodgers with the conduit.

When Sparks returned, he found Rodgers standing with a bending hickey in his hand looking at a joint of conduit that was crookeder than a black market sugar salesman.

"Having a little trouble?" Sparks asked.

"—, yes!" Rodgers replied. "Seems like the only way I'll ever get the conduit to fit is by changing the wall."

"Let's see." Sparks laid the roll of cable down, took out his rule and began measuring. He then threw an offset in the pipe and made two 90 deg. bends. When placed in position, the conduit fitted like paper on the wall. "Now if we cut it off here and make an offset to the switch box it should go."

"Gosh!" Rodgers exclaimed, "that looks easy, but I sure wasn't doing any good at it."

"Ever bend much conduit?" Sparks inquired casually.

"No," Rodgers hesitated a moment, "in fact, practically none, but I figgered it wasn't very hard to do."

"Takes a little practice," Sparks commented. "If you'll cut this off where it's marked and thread it, I'll hang the switch."

THE job of wiring the caboose wasn't very complicated. Besides the marker lights, there were only four outlets, three lights in the caboose proper and a reading light over the conductor's desk.

While the electricians were doing the wiring, a conductor came in. "How many convenience outlets are you putting in?" the conductor asked.

"The print doesn't call for any," Sparks explained.

"Well, I want at least two or three," the conductor said. "Let's see—I'll want one by the stove, a double one for a toaster and a percolator, and one at this end for a fan. That'll do if both are double outlets. I'll want to plug in a radio," he added.

"Better talk to the boss," Sparks advised, "and if he says to, we'll put a receptacle by the bunk for an electric blanket also."

The conductor talked to the car foreman, master mechanic, and electrical engineer, each in turn. When last seen he was looking for the O.R.C. representative to take the matter up with him.

The wiring was finished, sans convenience outlets, that day, and the caboose went out that night all lit up like a Neon sign.

While the electricians were wiring the first caboose to be equipped, carmen were building a room for the Diesel plant. The room was on one side of the caboose and about midway from each end.

"Where are the starting batteries?" Sparks asked McWilliams when the generator was hoisted into the caboose.

"Not any," the electrical engineer replied. "It's started with air. There should be a reservoir somewhere in the material."

Wiring the caboose for lights didn't take quite as long as the previous one, but getting the plant installed took most of another day. When the job was finished, an air hose was connected to the Diesel air reservoir and the rip track supply line for starting the engine.

The Diesel started right off and the caboose began quivering like a dish of Jello in an earthquake. Sparks dropped a pair of side cutters. They landed on a piece of galvanized iron used under the caboose heating stove.

"What was that?" McWilliams asked when he heard the clatter.

"Some of my bridgework shook loose, I think," Sparks yelled.

McWilliams stopped the Diesel. "Not so good," he said. "I had an idea there would be some vibration but never figured it would shake the nails out of the siding.

"Yeah, doesn't look like it would vibrate so badly mounted on rubber," Sparks commented.

"Guess we'll have to do a little more figuring or else the boss' pet will have to be discarded."

"The boss' pet?" Sparks asked.

"The mechanical superintendent," McWilliams replied, "he likes the idea of a Diesel plant started with air. He figures all that will be necessary is to fill the fuel tank occasionally and change oil in the engine. And, by the way, I had a wire from him this morning. He's sending a small Diesel job—2 kw. He talked about it before I left. Just fill the fuel tank once a month; it's air started, too," the electrical engineer added.

"Little small for a Diesel, isn't it?" Sparks said.

"Well, yes. Speed regulation will be a problem on account of the difficulty in metering so small amount of fuel. Even if we burn kerosene as will probably be necessary, propane would be better, but the boss doesn't like propane, says it is not always available everywhere it might be needed." McWilliams looked at his watch. "Say, it's past your quitting time. I'm going to stick around and see what I can figure out about reducing the vibration of this outfit."

THE electrical engineer received a message that night to meet the mechanical superintendent in Kansas City. McWilliams left word for the electricians to go ahead on the caboose wiring while he was gone.

McWilliams didn't return until the next Monday night and was on the job Tuesday morning. He found that the electricians had wired two cabooses and started on another while he was gone.

"Go ahead and finish wiring the caboose you have started," McWilliams told the electricians. "I'll ask the car foreman to have his men build the room for the 3 kw. propane job."

The electricians finished wiring the caboose that afternoon. Next morning the electrical engineer said they might as well hang one of the axle-driven generators. The axle driven generator was one of the 4 kw. generators used on coaches before air-conditioning increased the electrical demand. Two of them were to be used, one driven with a flat belt, the other using a V-belt.

Hanging the generators presented something of a problem. They finally had to have the blacksmith make some brackets to use for the job. It took almost three days to mount the two generators and place pulleys on the axles.

In the meantime, the 5 kw. Diesel job was just riding around doing nothing. The engine was started a couple of times but the conductor and brakeman each time decided to use oil lamps rather than endure the vibration.

"When I try to write with that thing running, I make dotted lines," the conductor said.

Friday afternoon, just before quitting time, Sparks noticed the caboose with the Diesel job in it. He walked over and looked at the engine. Sparks was so intent on trying to figure out a method of reducing the vibration that he didn't notice McWilliams enter the caboose.

"Figure anything out, Sparks?" McWilliams asked.

"Well,"—Sparks reached up and scratched his head—"I don't know whether I have or not."

"What's your idea?"

"Chances are, it won't work," Sparks objected.

"Then again it might. Anyway, let's have it."

"Well, what I thought was that instead of mounting the engine on rubber, just sort of hang it between some supports with rubber something like some automobile engines are supported." Sparks took a piece of marking crayon and began making a sketch on the floor of the caboose.

"Oh, yes, I see,—mount the engine with the rubber in shear instead of in compression," McWilliams said. "You know, it might work at that. Anyway, it's worth trying."

The whistle blew while McWilliams was talking and Sparks started to leave. The electrical engineer stopped him. "Stick around a while: if we can get this thing worked out, it's worth a little time and a half."

That night the electrical engineer mailed a letter to the system storekeeper asking him to obtain rubber pieces for mounting the engine as shown by the enclosed sketch.

THEY had four electric lighted cabooses in service and wiring finished in the fifth before the rubber pieces for changing the mounting of the Diesel arrived, also the battery job, two axle-driven installations and the propane generator set.

The battery job made half a dozen trips in nice shape. When it came in each time, the batteries were not quite half discharged. Then it came in with the battery dead. It was fully charged and went out and came back dead again. When this happened three times in succession, the electrical engineer began to be worried. The wiring was checked and found to be clear of shorts. Even if all of the lights had been left turned on the entire time the caboose was out of Plainville between chargings, the battery should not have been completely discharged. McWilliams had an idea that perhaps the train crew was connecting appliances on the line but could find no evidence to that effect.

Finally he went to Sanford where the caboose tied up. There he found why the batteries were discharged. The conductor and two brakemen were using the caboose for sleeping quarters. The weather was cold. Somewhere the conductor had picked up an electric heater. It was originally for 110 volts but an electrician in Sanford had paralleled the strip heating elements to adapt it for use on the 32-volt system. The heater was connected at the switch and left on all night to keep the caboose comfortable.

The axle driven jobs were giving trouble, too. Both of them came in almost every trip with belts missing. The one using a flat belt seldom came in with the belt not missing. Belts had to be replaced and batteries charged each time.

The only job operating anywhere near satisfactory was the propane set. It being air cooled, showed a tendency to heat at times.

"I believe if the propane engine were liquid cooled, it would be okay," McWilliams remarked.

The small Diesel outfit and pieces of rubber for mounting the larger one arrived at about the same time. Sparks was so busy putting on belts, testing and charging batteries that he didn't have much time left for other work. McWilliams was scratching his head trying to figure out some way to prevent the belts from breaking. He knew that coupling shocks were causing the belts to break, but didn't see any way to avoid them. He finally had Sparks reduce belt tension to approximately one-half normal. That practically stopped belt breakage, but it also reduced generator output to about half normal capacity. The belts would slip when the generator became loaded, which didn't do the belts any good. The V-belt drive operated more efficiently with reduced tension than did the flat belts.

"Guess we'll just have to reduce the generator output," McWilliams told Sparks. "About as good a way as any, without equipment for running the generators here at the terminal, is to ride the caboose and set the regulators.

MCWILLIAMS and Sparks rode the caboose having the axle driven generators and set the regulators. Each of them was set to allow a charging rate slightly below the point where the belts started slipping. The output was reduced to slightly less than 2 kw. but that would be sufficient for any contemplated load.

"We may have to put circuit breakers in the line if the train crews start connecting up any more heaters or other devices," McWilliams said.

"Now I guess we'll install the little Diesel and see how it works," the electrical engineer said next day after they returned from riding the cabooses.

It wasn't much of a job setting the generator in place in the caboose. The engine started and ran nicely. Speed regulation was better than McWilliams had anticipated until the engine warmed up, then it began hunting. The electrical engineer, with Sparks assisting, worked all forenoon adjusting the governor. Finally, McWilliams, entirely disgusted, said, "Well, let's let it make a trip and see what happens."

The caboose returned with every bulb burned out and the conductor ready to blow a fuse himself.

Again they made changes and adjustments but still the Diesel would run like a frog walking, steady by jerks, first too slow, then too fast.

"The boss is not going to like it," McWilliams said, "but I'm very much afraid the little Diesel idea is just a beautiful dream."

After the method of mounting the larger Diesel was changed, the vibration was reduced sufficiently to not be objectionable. Speed regulation too was fairly good.

"Not too bad," McWilliams commented, "and we may reduce vibration more by cushioning the supports."

All of the electric lighted cabooses except the one with the little Diesel were doing fairly well. The one having the battery only went out on a work train and was out of the terminal three or four days. The battery was discharged when it came in.

"That might happen to an axle driven job, too," McWilliams commented.

Finally the jobs were all completed. Sparks was instructed to keep a record of all service and attention given any of the electric lighted cabooses. The report was to be turned in each week to the master mechanic who would forward copies to the mechanical superintendent and electrical engineer.

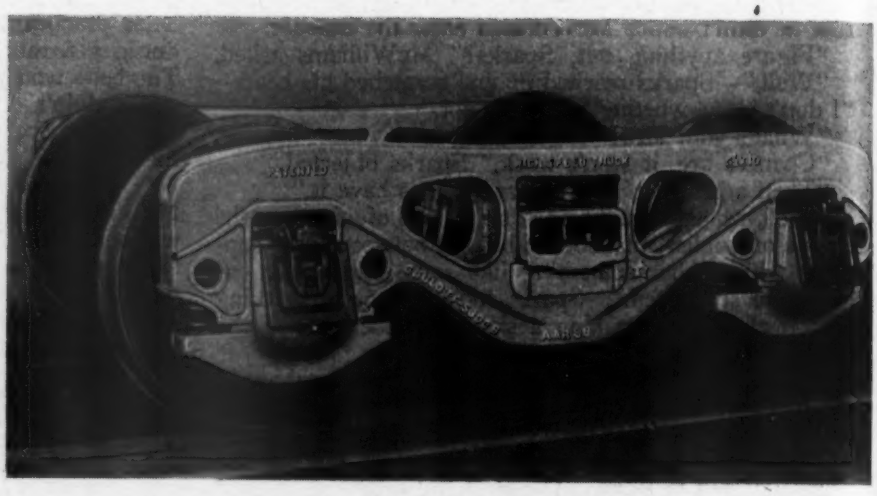
McWilliams was saying goodby to the master mechanic. "What type of equipment do you intend to recommend?" the master mechanic asked.

"Who? Me? I'm not going to recommend any. The boss will get the reports. I'm going to keep my neck in where it belongs and let him make the recommendations!"

NEW DEVICES

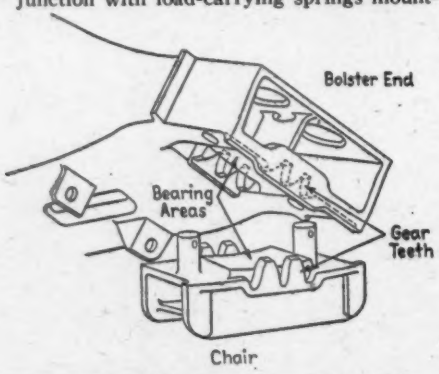
High Speed Freight Car Truck

A high-speed freight truck designed to operate at passenger-train speeds with maximum protection to lading and car structure has been introduced by The Symington-Gould Corporation, Rochester, N. Y. This truck is the result of intensive research, including laboratory and road-test work and a study of the external forces to be absorbed, all directed towards increasing the safe carrying capacity and reducing the fatigue stresses in the cast-steel side frames, and secondarily the improvement of the riding quality of freight trucks by the prevention of harmonic spring action and by more nearly complete absorption of service vibrations and shocks.



The Symington-Gould high-speed freight truck

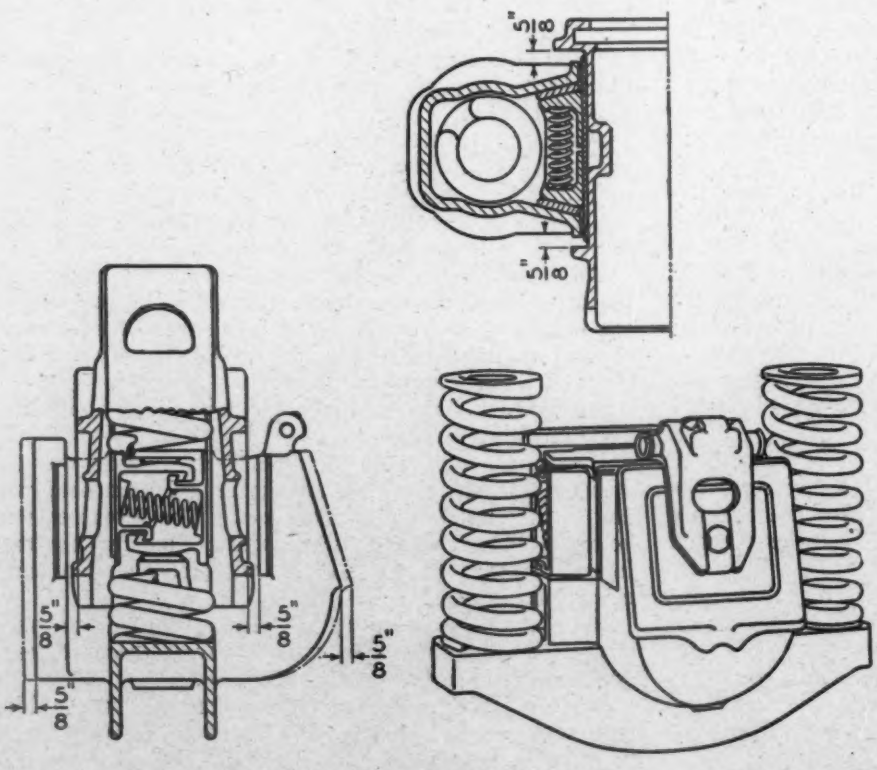
Separate journal boxes are used in conjunction with load-carrying springs mounted on the sides of the boxes rather than under the bolster. This construction reduces materially the unsprung weight and prevents the direct transmission of service shocks to and through the side frames by absorbing these shocks as closely as possible to their point of origin.



The interlocking connection between the bolster and the side frame

The spring-supported pedestal-type side frames function as free acting equalizers which adjust themselves independently to rail depressions or elevations. This function is made possible by the interlocking rolling connection between the bolster and the chairs carried by the side frames. The bolster end loads are carried on ample rolling bearing areas on the bolster chair and the bolster end. Flanking these curved bearing areas are lines of large-pitch gear teeth which form a positive interlocking resistance against longitudinal shocks. These teeth maintain the squareness of the truck and at the same time permit substantially free independent equalizing movement by allowing the side frames to rock under, and with respect to, the bolster ends without any vertical load on the teeth. The chairs normally rest on the bottom member of the side frame, but allow the application of shims between them and the frames to adjust coupler height.

The journal boxes move laterally relative to the frames through the controlled tilting of the pedestal springs. The pedestal jaws instead of having flat faces, are open towards the box and are outwardly beveled. On each side of the journal box are two horizontal shelves between which are placed expanding type snubbers, the beveled shoes of which press against the inside walls of the pedestal jaws. Constant control of both lateral and vertical movement is effected by the snubbers, which are constrained between the shelves to move vertically with the box but are free to move laterally with the side frame relative to the journal box for a predetermined distance.



Application of the snubbing unit to the journal box

Vertical pedestal spring movement is snubbed directly by the expansive force of the snubber spring pressing the snubber shoes against the beveled sides of the pedestal jaw. Lateral motion of the box is similarly controlled by a component of this expansive force created by the effect of the beveled sides against liners on the sides of the box. This lesser force is sufficient to prevent lateral harmonic build-up but does not delay the restoration of the journal box to its normal position after lateral displacement. A third function performed by the snubber spring is to keep the two shoes of the snubber snug against their respective horizontal shelves which constrain them to move vertically with the box. This is accomplished by disposing the snubber spring at a slight angle with

the horizontal, whereby one shoe is held tight against the upper shelf while the other is held against the bottom shelf.

The pedestal springs therefore perform two functions: carrying the vertical load and permitting lateral motion of the boxes. The snubbers also perform two functions by preventing harmonic spring build-up both vertically and laterally.

The close spacing of the springs and the placement of the snubbers lessen the tendency of the journal box to rotate. The equalizing action of the side frames plus the independent pedestal springs enable the separate journal boxes automatically to adjust themselves to track warp which causes constant variation of the wheels from a level plane. The ample provision for journal box movement relative to the side frames permits the use of roller bearing boxes when preferred.

To these trucks may be applied either the conventional arrangement of brake-beam suspension, or longitudinal brake-beam supports hung from the bottoms of the journal boxes. This latter arrangement comprises two longitudinally mounted I-beam sections extending between the journal boxes on each side of the truck and carried on supports cast integral with the bottoms of the boxes. Guide brackets mounted on these longitudinal I-sections support the brake beams which have suitable end extensions. The brake shoes move laterally with the journal box and are applied to the wheel treads at the same point and at the same angle of contact regardless of any variation in the weight of the car lading or in the spring travel. When these box-mounted supports are installed, the necessity for auxiliary brake-beam safety supports or leveling devices is eliminated.

Gauge Measures Pipe Thickness From Outside

A thickness gauge designed to measure the thickness of iron or steel pipes from the outside has been announced by the Special Products Division of the General Electric Company. Called a pipe thickness gauge, Type MS-A, the new instrument can be used on pipes up to ¼ in. in thickness and from 1 to 2 in. in diameter. Applications include checking the safety factor of pipes and tubing carrying petroleum products, chemicals, steam, or gas.

Thickness gauge being used to check pipe thickness

The gauge consists of an indicating instrument, a gauge head, and a saddle which is connected to the gauge head by two screws. A different saddle is required for each diameter of pipe. To operate, the saddle is placed upon the pipe, and thickness is indicated in fractions of an inch on the indicating instrument.

The gauge measures the average thickness of a pipe over an area of several square inches. Accuracy of plus or minus 1/64 in. can be obtained on clean surfaces, and 1/32 in. on dirty surfaces. Dirt, scale, and paint on the inside of a pipe do not add to the thickness reading. The gauge head and saddle combination weighs about 6½ lb. The instrument operates on 115-volt, 60-cycle power.

Circuit Tester

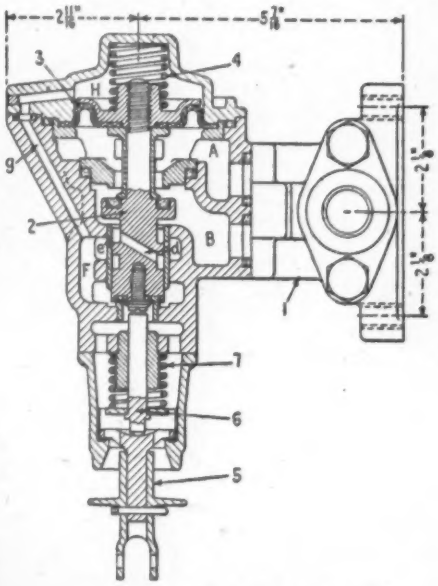
A small pocket-size device, called the Polyvoltester, for determining a number of electrical circuit conditions, is being offered by the Fox Valley Instrument Co., Box 603, Ingleside, Ill. It will show when a circuit is live or dead. It will distinguish between 220 or 110 volts, will determine whether a circuit is a.c. or d.c., and will distinguish between directions of phase rotation. It will also identify the positive and negative wires on d.c. circuits, and can be used on voltages up to 440. The tester incorporates two small neon lamps and resistors so arranged that the instrument will not indicate when connected between a live circuit and the capacitance of a dead wire.

The tester is easily portable and is not damaged by moisture or improper connection

When the two outside leads of the tester are connected across 440 or 220 volt single-phase a.c. circuit, both lamps will glow, and if across 110 volts neither lamp will glow. If the center lead and one outside lead is placed across 110 volts, one lamp will glow. To determine phase rotation, the left lead of the tester is connected to the left circuit terminal, and the right lead to the right terminal. When the center or third power terminal is connected, one of the lights on the tester will become brighter and the other dimmer. If it is the left light, it indicates phase rotation in one direction and if it is the right light, rotation is opposite. The tester cannot be damaged by improper connection to any circuit up to 440 volts.

Brake Cylinder Release Valve

To lessen the time consumed in draining the air from the reservoirs and brake cylinders prior to switching present-day freight cars equipped with AB brakes, the New York Air Brake Company, 420 Lexington avenue, New York, has developed a brake cylinder release valve the use of which saves time in two ways.



The brake-cylinder release valve

Instead of having to hold open the release valve which is part of the AB Control Valve during the entire interval required to drain the brake system completely, with this new release valve it is necessary only to make a brief pull on the release rod. This pull serves to cut off the supply of air to the brake cylinder and to drain it without further attention. Thus the overall time required for bleeding the cars is little more than that required to walk the length of the string of cars.

Savings in both time and air are effected when re-charging the system since this release valve retains the charge in the reservoirs when it releases the brakes.

Referring to the Sectional View of the brake-cylinder release valve, during applications of the AB Brake, air is free to flow from the AB control valve through bracket *1* into chamber *A*, past valve *2* and out to the brake cylinder through chamber *B* and the brake cylinder connection to the bracket. At the same time air also flows from chamber *B* through annular drilled ports *e*, chamber *F* and passage *g* into chamber *H* where it exerts pressure on diaphragm *3* to assist spring *4* in holding valve *2* on its lower seat against the pressure in chamber *A* on the other side of the diaphragm. In releasing the brake the air is free to flow in the opposite direction so that the brake functions normally.

When a car is to be prepared for switching the brake pipe is exhausted, applying the brakes in emergency or full service so that the chambers and passages in the release valve are charged to brake-cylinder pressure. A pull on release-valve handle *5* lifts plunger *6* against the tension of spring *7* to push valve *2* off its lower seat and close communication through ports *e* from chamber *B* to *F*. Chambers *F* and *H* are quickly exhausted to the atmosphere through the lower valve seat and brake cylinder pressure in chamber *A* acting on the diaphragm forces valve *2* to its upper seat, closing communication between the control valve and the brake cylinder. The release valve is then set and requires no further attention. With valve *2* in its upper position passage *d* connects chamber *B* and the brake cylinder to the atmosphere through ports *e*, chamber *F* and the lower seat.

Since the AB control valve is in full service or emergency position chamber *A* is connected to one or both of the reservoirs so that the release valve will remain in this position until brake-pipe pressure is restored to return the control valve to release position. When this is done chamber *A* is exhausted through the control valve brake-cylinder release ports and spring *4* returns valve *2* to its lower seat, restoring the normal functioning of the brake system.

This brake cylinder release valve is designed to be installed on its own pipe bracket in the line between the AB Control valve and the brake cylider. No other pipe connections are required.

Spring Hinge and Door Lock Combination

A new combination to further economy and actuate one man closure of the heaviest individual drop bottom gondola doors is being announced by the Wine Railway Appliance Company, Toledo 9, Ohio. This combination includes a new spring hinge in conjunction with an improved Wine master drop door lock to assure easier, faster and positive operation of drop bottom doors under the most adverse conditions. The spring hinge is an entirely new development while the master lock is an advancement of the old type Wine drop bottom lock.

The lock has been improved by the addition of a pry-bar fulcrum on the bracket casting as well as an adjustable door beam extension. The pry-bar fulcrum eliminates the pry-bar loop, or fulcrum plate, on the side of the car between each pair of locks and it gains the advantage of placing the fulcrum nearer the point of operation. Now distorted doors may be closed easier and faster with the aid of a small pinch bar. The adjustable door beam extension makes possible correction of most irregularities between the door and the floor of the car. This means that loss of lading, through seepage, will be reduced to a minimum.

The spring hinge is a development which eliminates the necessity of more than one man being used to close even the heaviest drop bottom doors. It is designed about a coil spring. The actual function of the hinge is based on variable eccentricity which revolves about two standard hinge pins. A minimum moment arm is in effect when the door is open and it gradually increases as the door is closed. With the door open, the spring is in full compression and very little actual door weight remains for the operator to raise. Any weight door may be handled with ease by using one, two or even three spring hinges per door as is recommended with an extra heavy cast-steel door.

The new combination does not change the optional operation feature of Wine drop bottom gondola locks. Single- or multiple-door opening is provided for the consignee and full control of lading can be maintained at all times.

The Wine spring hinge and master door lock combination enables one man to close the heaviest drop bottom gondola doors

Reflector Lamps

A complete line of reflector type incandescent lamps is now being offered by the Lustra Corporation of America, 40 West 25th Street, New York. Included are neck-silvered direct and concentrating lamps, side-silvered tubular types and various floodlights and spotlights designed to produce individual lighting patterns from very wide beams to narrow high-intensity beams.

Construction features include silver reflector linings sealed inside the bulbs, neck-reflector disks, precision-focused filaments, and daylight spray for color-corrected illumination where desired. The lamps are made in sizes ranging from 25 to 1,000 watts for 115 to 125 volts, and up to 250 volts on the general lighting service types.

Dual-Drive Lathe

A lathe with twelve spindle speeds all controlled by a single lever, including four high speed for use with carbide tools, is manufactured by the R. K. LeBlond Machine Tool Company, Cincinnati 8, Ohio.

The LeBlond dual-drive lathe

Known as the LeBlond Dual Drive, it has two separate driving arrangements, a gear drive and a direct belt drive. The machine swings 15 in. over the bed ways, can be built with center distances starting at 30 in., and is powered by a 3-hp. main drive motor.

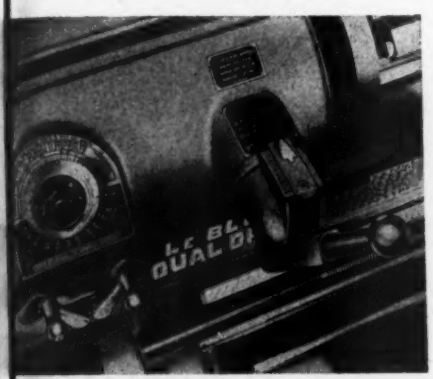
The low speed, or gear drive, runs from the main V-belt motor drive through a gear train to the spindle and has eight speeds varying from 28 to 445 r. p. m. The high speed, or direct belt drive, runs through four gear speed changes to a high-speed shaft, then direct to the spindle through a second double V-belt drive. The gear drive is cut out completely in this range of four speeds from 540 to 1,800 r. p. m.

The spindle and drive shafts run on anti-friction bearings. The gears and shafts are of alloy steel and run in oil provided by an automatic forced-feed lubricating system. The quick-change feed box is totally enclosed, and the gears are lubricated by oil pumped automatically from the main reservoir. Drive, tumbler, and cone

gears in the feed box, and many moving parts within the headstock, are flame hardened for durability. A multiple-disc clutch with two-station control, multiple automatic length stops, and a chip pan are furnished as standard equipment.

The lathe is mounted on two cabinet legs. The tail end leg contains the oil reservoir, the coolant pump, and the tool storage locker. The electrical control panel is located on the head end leg and contains the main drive motor, the start-stop push buttons, and the drum switch for presetting direction. This panel is completely wired and fitted with coolant-pump start-stop push buttons so that the pump and piping may be added as extra equipment at any time.

Also incorporated in this lathe are three well-established LeBlond devices: a one-piece apron with a positive-jaw feed clutch;



A single lever controls all 12 spindle speeds on the Dual-Drive lathe

one-shot lubrication to all apron bearings, cross slide, and carriage ways; and a rapid speed selector for selecting the correct cutting speeds for all commonly machined materials.

Lubricator Filling Equipment

A complete line of equipment, including oil guns, hoses and fittings, for filling mechanical lubricators is announced by the Prime Manufacturing Company, 1669 South First street, Milwaukee 4, Wis. Available in various models for valve oil and for engine oil, the oil guns may be either air or hand operated and equipped with either steam or electrical heaters. All models are mounted on rubber tires with roller-bearing wheels for easy portability.

The guns are equipped with a 264-pint oil tank and are supplied with a heavy-duty 50-ft. oil hose complete with swivels, control valves and coupling bodies. Fittings for the valve-oil model differ from those supplied to the engine-oil model; the coupling bodies and the hose fit only one of the two fittings. In addition to the dimensional difference of the two fittings the valve-oil coupling bodies are made of hex stock while the engine-oil coupling bodies are square to provide a quick visual check.

The design of the fittings eliminates the need for removing plugs from the lubricator lids. The oil pumped into the lubricator is kept clean because it is not exposed to the atmosphere and because the fitting through which it is pumped has a stiff spring seat to seal out dirt. By using Prime valve-oil and engine-oil fittings it is impossible for a workman inadvertently to put valve oil in a lubricator requiring engine oil, and vice-versa. The necessity of a workman climbing on the guides to get at the lubricator is eliminated by the retractable ladder, the bottom of which acts as a leg or support to eliminate the hazard of the front wheel swiveling while the workman is on the ladder.

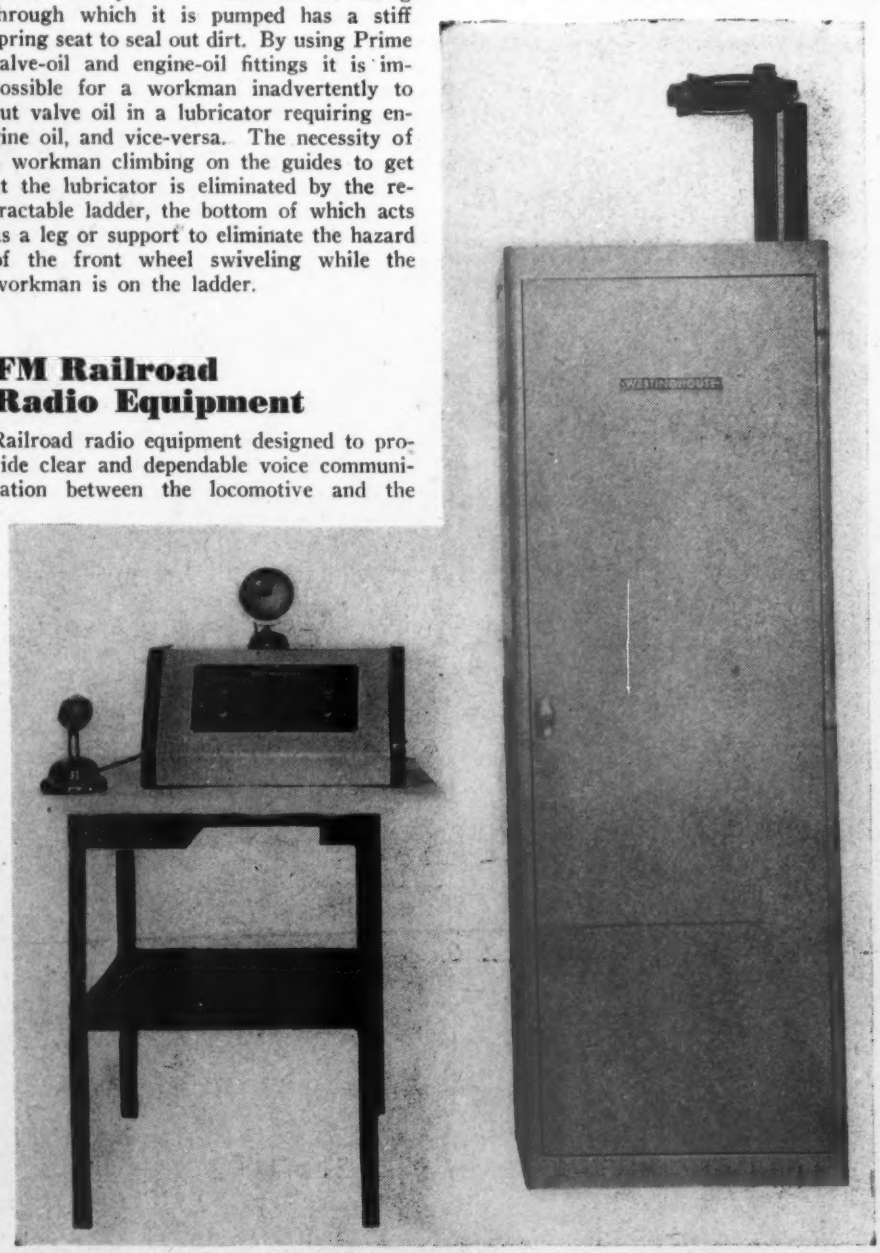
The pump of the hand-operated model may be operated either from the floor or the ladder

FM Railroad Radio Equipment

Railroad radio equipment designed to provide clear and dependable voice communication between the locomotive and the caboose, between trains on the same or adjacent tracks, between the train and wayside station, or between yard locomotives and the yardmaster's office has been made available by the Westinghouse Electric Corporation.

The equipment is composed of two basic assemblies: fixed station assemblies for installation in wayside stations and yards, and mobile assemblies for installation on the locomotive or caboose; both operate on a standardized power supply of 117 volts a.c. Rotary converters are supplied with mobile units to produce the required a.c. voltage from either a 32- or 64-volt d.c. supply.

Frequency modulated, the transmitter operates in the 152-162 megacycle band. The output frequency is obtained by use of frequency multipliers which follow a crystal controlled oscillator. A tone generator for calling purposes, and an automatic level control circuit to prevent excessive audio input and distortion are mounted on the transmitter chasses. Standard vacuum tubes are used throughout.

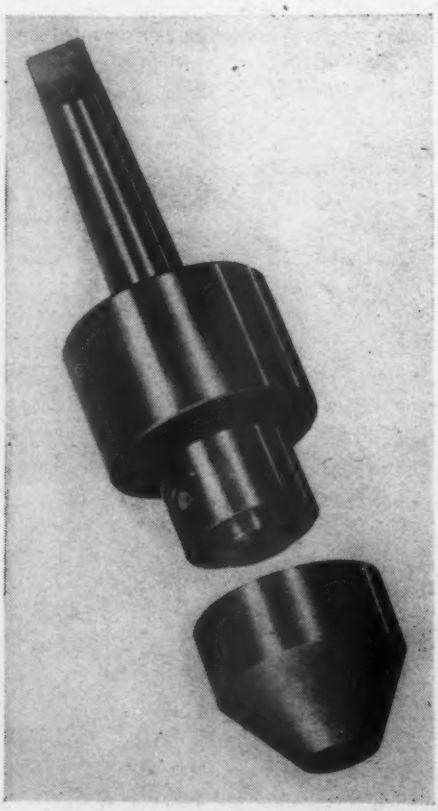


Fixed station equipment including microphone, control console, loudspeaker and receiver-transmitter with antenna

Flexible Tool Holder

The Tool-Flex flexible tool holder incorporates a floating feature to minimize breakage, rejects, and set-up time in tapping and reaming operations. The tool floats in oil-resistant Neoprene in this development of the Burg Tool Manufacturing Company, 6709 South San Pedro street, Los Angeles 3, Calif. The flexibility and resilience of the Neoprene mounting aids in keeping taps centered and absorbs shocks. In reaming operations the use of the Neoprene mounting makes possible a better follow-up of the original hole, and lessens the chances of chattering or bell mouthing.

The tool holder consists of four parts, a shank, a collet, an inside and an outside

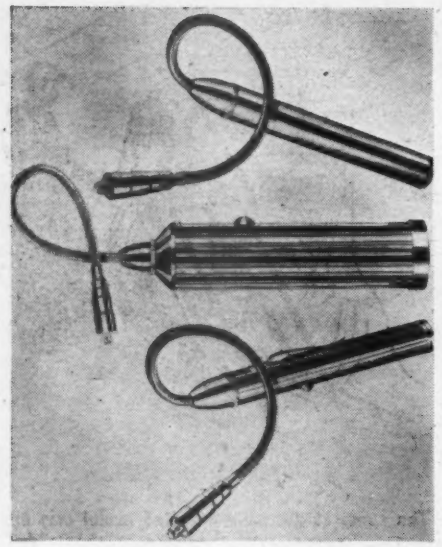


The Tool-Flex flexible tool holder

socket. All metal parts are made of alloy steel, heat-treated and finished to close tolerances. It has a positive drive, and comes in four models. Model B has a straight shank and straight collet, Model C a taper shank and taper collet, Model D a straight shank and taper collet, and Model E a taper shank with a straight collet. The railroad models are equipped with square sockets and accommodate the squares of taps and reamers from 7/16 in to 1 5/16 in.

Flex-Lites

Flashlight equipment with a long flexible extension bulb-retainer which replaces the conventional bulb assembly is manufactured by the Aero-Motive Manufacturing Company, 1803 Alcott street, Kalamazoo 24, Mich. With this construction a beam of light can be introduced into heretofore inaccessible areas.



The three models of the Flex-Lite

They are made of polished aluminum in three models and are said to be light-weight, sturdy and waterproof. The Junior model with a screw-type switch in the base and the Junior deluxe model with a pocket clip and thumb-type sliding switch for positive contact have overall lengths of 15 in. and use two standard-size AA Penlite batteries. The Master model, 16½ in. overall, uses two regular-size flashlight batteries, and also has a thumb-type switch.

Sleeve and Tube Bonding Machine

The danger of personal injury resulting from the failure of locomotive steam pipes due to improperly bonded sleeves or collars is said to be eliminated by a machine developed by the Gustin-Bacon Manufacturing Company, Kansas City 7, Mo. The

The Gustin-Bacon sleeve and tube bonding machine

machine consists of four adjustable burners equally spaced around a graduated cone designed to accommodate tubes of any diameter up to and including 3½ in.

The burners are mounted in adjustable manifolds which are fed gas and air through individual systems with separate valve controls. The sleeves are heated equally throughout by the four burners to give proper fusion and distribution of the bonding metal, and to produce a homogeneous bond said to be of greater tensile strength than the tube itself, even in the case of double-strength material.

The temperature of the gas flame at the burners is not high enough to overheat and damage the metal or to destroy the strength of the bond, but it quickly brings the metal up to the best bonding temperatures, which range from 1,200 to 1,650 deg. F. Any of the standard commercial bonding materials having a low melting point of approximately 1,165 deg. F., but not less than 1,100 deg. F., which is well above the maximum steam temperature, may be used with the machine. The machines are available for use with natural, artificial or propane or other liquefied petroleum gas.

The welder will supply two circuits with 270 amp. or one circuit with 540 amp.

Twin-Unit Outdoor Welder

A twin-unit, outdoor a.c. arc welder in a single enclosure has been announced by the Electric Welding Division of the General Electric Company. Each of the two circuits in the welder can be used simultaneously and independently with electrodes up to 3/16 in. in diameter, or combined into one circuit for heavy welding with ⅜-in. electrodes. The units have a current range of from 90 to 270 amp., when used singly, and from 180 to 540 amp., when operated in parallel.

Both welders are equipped with control which reduces the open-circuit voltage to approximately 30 volts when the machine is not welding, but which makes full power available the instant the arc is struck. Both halves are supplied through a single set of primary terminals, so that only one power-line circuit to the units is required.

Protection against rain, snow, and sleet is provided by drip-proof construction of all openings in the top of the enclosure and by a sealed window over the current indicators. Ventilating openings at top and bottom are of such proportions that they shed water and keep the ventilating air velocity low.

NEWS

A. S. M. E. Railroad Division Program for 1947

At the annual meeting of the American Society of Mechanical Engineers, Railroad division, in New York on December 4 and 5, 1946, it was decided to hold two technical meetings during 1947 and the following general subjects were tentatively assigned: Semi-annual meeting at Chicago on June 17—Diesel locomotive design from the manufacturers' viewpoint; annual meeting at New York in December—One session on modern motive-power developments, including gas-turbine types, and two sessions devoted to features of modern freight-car design.

New officers-elect of the A. S. M. E. Railroad Division Executive committee, installed at the annual meeting, included: Chairman, W. C. Sanders, general manager, Timken Roller Bearing Company, Railway division, Canton, Ohio; P. W. Kiefer, chief engineer, motive power and rolling stock, New York Central System, New York; B. S. Cain, assistant engineer, Locomotive division, General Electric Company, Erie, Pa.; J. M. Nicholson, mechanical assistant to vice-president, Atchison, Topeka & Santa Fe, Chicago; E. D. Campbell, vice-president, American Car and Foundry Company, New York; secretary, E. L. Woodward, western editor, *Railway Mechanical Engineer*, Chicago.

Four new members were elected to membership in the General committee. Frank Murphy, chief engineer, Pullman-Standard Car Manufacturing Company, Chicago, was elected in place of Mr. Campbell who was advanced to the Executive committee. Mr. Murphy's term will expire in 1947. The three new members elected to the General committee with terms expiring in 1951 included: G. W. Bohannan, assistant chief mechanical officer, Chicago & North Western, Chicago; C. D. Bryant, chief engineer, Technical board, Wrought Steel Wheel Industry, Chicago, and W. A. Newman, manager, Research department, Canadian Pacific, Montreal, Quebec.

A. A. R. Letter Ballot Results

The A.A.R. Mechanical Division has announced in a circular letter, dated December 9, from Secretary A. C. Browning, the favorable action by member roads on 72 committee recommendations or propositions submitted to letter ballot at the annual meeting of the Division in Chicago last August.

These individual propositions included Nos. 7, 29, 46, 48, 50 and 61, covering changes in the interchange rules which are approved for insertion in the 1947 Code of Interchange Rules; also Nos. 1 to 6, 8 to 21, 23 to 45, 47 to 60 and 62 to 72 to amend the standard and recommended practice of the division which are approved effective March 1, 1947, with the exception of Nos. 30 to 33, incl., covering definitions and designating letter for cars, which are approved effective immediately.

Prof. E. G. Young Dies

Everett G. Young, professor of railway mechanical engineering at the University of Illinois, Urbana, Ill., died at his home in that city on January 10, following a long illness. Professor Young had been associated continuously with the university since 1927, when he became research professor of railway engineering. He was the author of magazine articles, textbook material, and professional papers, reports and bulletins. He had been active in the work of various railroad clubs and associations, and served for a number of years on the committee for further development of steam locomotives of the Mechanical division, Association of American Railroads. Prior to joining the university faculty, Professor Young had taught railway mechanical engineering in Chinese engineering colleges. He later became assistant to the mechanical adviser of the Chinese Government Railway.

He was born on June 19, 1888, at Geneseo, Ill., and was educated at the University of Kansas and the University of Illinois. Professor Young began his career as a research assistant at the University of Illinois in 1914, and from 1916 to 1919 was a calculator and estimator for the American Locomotive Company. In the latter years he went to China, where he remained until 1927, when he returned to the University of Illinois.

Bruce Joins Research Group

A. W. Bruce, who recently retired as director of locomotive engineering, steam, of the American Locomotive Company, has been appointed assistant director of research for the Steam Locomotive Research Institute.

Orders and Inquiries for New Equipment Placed Since the Closing of the January Issue

Locomotive Orders

Road	No. of locos.	Type of loco.	Builder
Chicago Great Western	6[1]	3-unit 4,500-hp. Diesel-elec. frt.	Electro-Motive
Southern Pacific	23[2]	1,000-hp. Diesel-elec. switching	American Loco. Co.
Union Pacific	25[2]	1,000-hp. Diesel-elec. switching	Electro-Motive
	4[2]	1,000-hp. Diesel-elec. switching	Fairbanks, Morse
	2[2]	3-unit, 6,000-hp. Diesel-elec. pass.	American Loco. Co.
	5[2]	3-unit, 4,500-hp. Diesel-elec. pass.	Electro-Motive
	10[2]	4-unit, 6,000-hp. Diesel-elec. frt.	American Loco. Co.
	18[2]	4-unit, 6,000-hp. Diesel-elec. frt.	Electro-Motive

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Ontario Northland	500	40-ton box	National Steel Car

Freight-Car Inquiries

Road	No. of locos.	Type of loco.	Builder
Chesapeake & Ohio—New York, Chicago & St. Louis	1,600[3]	50-ton box	
	1,000[4]	70-ton hopper	
Southern Pacific	3,000	Box	
	1,500	Drop bottom gondola	
	500	Gondola	
	500	Automobile	
	500	Flat	
	100	Covered hopper	
	100	Gondola sulphur	

Passenger-Car Orders

Road	No. of locos.	Type of loco.	Builder
Pennsylvania	10[5]	Sleeping	American Car & Fdry
	4[5]	Coach-bar-lounge	American Car & Fdry.
	3[5]	Coaches	American Car & Fdry.
	2[5]	Bagg.-dormitory	American Car & Fdry.
	2[5]	Dining	American Car & Fdry.
	1[5]	Buffet-bedroom-lounge	American Car & Fdry.
	1[5]	Sleeping	Budd

[1] Delivery scheduled for June of this year.
[2] Scheduled for delivery during January, February, and March.
[3] The estimated cost of the 29 switchers is $3,000,000; of the 7 passenger and 28 freight units, $19,000,000. The 64 new units will afford complete Dieselization of the U. P. south of Salt Lake City, Utah, by the fall of 1947, according to G. F. Ashby, president of the road. Upon delivery of the locomotives, Mr. Ashby says, the road will have a total of 178 single Diesel units for freight and passenger traffic and 141 Diesel switch engines. When all of this equipment is received, the Union Pacific will have—including the 45 units now in use on passenger trains and the 112 Diesel switchers now in service—a total of 421,500 hp. in Diesel-electric locomotives—112,500 hp. in passenger service, 168,000 hp. in freight service, and 141,000 hp. for switching activities.
[4] 1,000 for the C. & O.; 600 for the Nickel Plate.
[5] To be equipped with roller bearings.
[6] Equipment to cost $3,300,000. Thirty of the cars will be used to replace "Sunshine Special" equipment now in service.

Notes:—The *Chesapeake & Ohio* has announced its intention of requesting bids on 10 steam locomotives to be used in passenger service. Five of the locomotives, it is contemplated, will be of the 4-8-4 type, each with a tractive force of 80,200 lb., and five will be of the 4-6-4 type, each with a tractive force of 64,700 lb. All the new engines will be streamlined and equipped with roller bearings, high-speed boosters, lightweight main and side rods and crossheads. The use of poppet valves is being considered in the case of the 4-6-4 locomotives, which will be put into service between Hinton, W. Va., and Cincinnati, Ohio, and between Hinton and Toledo, Ohio, the C. & O. said. The 4-8-4 engines will be assigned to the trans-Allegheny mountain run between Richmond, Va., and Hinton.

The *Reading* has authorized the purchase of 15 Diesel-electric switching locomotives to cost $1,342,500.

The *Seaboard Air Line* has authorized the purchase of 500 box cars, 175 phosphate cars, and 10 Diesel-electric locomotives, of which six will be road engines and four will be switchers. The cost of the new equipment was estimated to be between $4,000,000 and $4,500,000.

"Charles H. McCrea Medal" Established

THE establishment of an honorary award, known as the Charles H. McCrea Medal, to be given annually to the individual rendering most meritorious service to the malleable-iron industry, was announced by the Malleable Founders Society on January 10.

The medal is presented to the Society by National Malleable & Steel Castings Co., in memory of its late president, Mr. McCrea, who was a director of the Malleable Founders Society from 1939 until his death in 1946. The recipient will be chosen each year by a committee of five members of the Society, with the president as chairman, and presentation will be made at the annual meeting in June.

The purpose of the award, according to the Society, is "to encourage and stimulate individual effort in the progress and development of the arts and sciences practiced in the production of malleable-iron castings." No restriction is placed upon the field of endeavor within the industry beyond rendering meritorious service. Candidates must be employed by a member company of the Society or by its staff.

Diesel Engine Manufacturers Elect Officers

AT the recent annual meeting of the Diesel Engine Manufacturers Association E. J. Schwanhausser, vice-president of the Worthington Pump & Machinery Corp., was re-elected president of the Association. Also returned to their posts as vice-presidents were J. E. Peterson, vice-president, General Machinery Corp., and Gordon Lefebvre, president, Cooper-Bessemer Corp. Robert H. Morse, Jr., vice-president and general sales manager, Fairbanks, Morse & Co., was again chosen to serve as treasurer.

Directors were elected as follows: William E. Corrigan, vice-president, American Locomotive Co.; George W. Codrington, vice-president, General Motors Corp., and general manager, Cleveland Diesel Engine Division; A. W. McKinney, vice-president and general manager of sales, National Supply Co.; Robert E. Friend, president, Nordberg Mfg. Co., Lawrence Schwenk, president, Busch-Sulzer Bros.-Diesel Engine Co., and G. F. Twist, vice-president and general manager, Atlas Imperial Diesel Engine Co.

Midwest Power Conference

METALLURGY of power plants, industrial electronics, and railroad power units will be the new subjects for discussion at the Midwest Power Conference to be held at the Palmer House, Chicago, March 31, April 1 and 2. The Conference will be sponsored by the Illinois Institute of Technology in cooperation with nine midwestern colleges and universities and seven engineering societies.

Resistance Welding Contest Offers $2,000 in Prizes

THE Resistance Welder Manufacturers' Association has announced that $2,000 in prizes will be awarded for outstanding papers dealing with resistance-welding subjects. Contest judges will be appointed by the American Welding Society, and awards will be made at the 1947 fall meeting of the society.

One prize of $750 will be awarded for the best paper emanating from an industrial source, consulting engineer, private or government laboratory, or the like, the subject matter of which is concerned specifically with resistance welding. There are no restrictions on the scope of the subject matter. A prize of $500 is offered for the second best paper from an industrial source, and a prize of $250 for the third best paper.

A prize of $300 will be awarded for the best paper emanating from a university source—that is, either an instructor, student or research fellow—which in the opinion of the Board of Awards is the greatest original contribution to the advancement and use of resistance welding; and a prize of $200 for the second best paper from a university source.

The contest is considered as having opened August 1, 1946, and will close on midnight, July 31, 1947. Papers entered in the contest should be sent to the American Welding Society, 33 West Thirty-ninth street, New York 18. The minimum length requirement for papers entered in this competition is 2,500 words.

Coal Research Program Enlarged

THE board of directors of Bituminous Coal Research, Inc., national research agency of that industry, has approved a budget of $447,200 for its general program of cooperative research and development projects to be carried on during 1947. This is in addition to large expenditures planned in 1947 for coal-burning gas-turbine locomotive research and development by the organization's locomotive development committee.

Miscellaneous Publication

ALUMINUM ALLOYS AND MILL PRODUCTS.—Reynolds Metals Company, Dept. 47, 2500 South Third street, Louisville 1, Ky. Wire-bound data book of 248 pages, 6 in. by 9 in. Price, $2. Describes Reynolds aluminum alloys and aluminum mill products—sheet and plate; extruded shapes; rolled formed shapes; tubing and pipe; wire, rod, and bar; forging stock; press forgings; ingot metal for sand castings; permanent mold casting, and die casting. Discusses also range of sizes, chemical compositions, yield and ultimate strengths, hardnesses, tolerances, etc. Color flags on two-page spreads, tied with a front color index, aid in locating any particular section.

Supply Trade Notes

SIMPLEX WIRE & CABLE CO.—*W. W. Lancaster* has been appointed sales representative of the Simplex Wire & Cable Co. in the New Orleans, La., area, under the supervision of A. K. Felix, southern district manager.

◆

H. K. PORTER COMPANY.—*Gilbert E. Collyer* has been appointed district manager of the Detroit, Mich., office of *H. K. Porter Company*. Mr. Collyer was formerly in the company's general sales office at Pittsburgh, Pa., where he specialized in equipment for the processing industries, locomotives, railway specialties and springs.

◆

CHICAGO MALLEABLE CASTINGS COMPANY; ALLIED STEEL CASTINGS COMPANY.—*Charles A. Bens*, in addition to his other duties as general sales manager, has been placed in charge of all engineering and development work for the Chicago Malleable Castings Company and the Allied Steel Castings Company, at Chicago.

◆

SYLVANIA ELECTRIC PRODUCTS, INC.—*S. B. Williams*, editor of the Electrical World for the past eight years, has been appointed manager of customer relations for the lighting division of Sylvania.

◆

KLASING HAND BRAKE COMPANY. — *Henry W. Stahl* has been appointed eastern divisional representative of the *Klasing Hand Brake Company*, Joliet, Ill. Mr. Stahl's headquarters are in New York.

◆

HILLIARD CORPORATION.—The Hilliard Corporation, Elmira, N. Y., has appointed *S. L. Powers*, 606 Williamson building, Cleveland, Ohio, as its representative in that area.

ROCKWELL MANUFACTURING COMPANY.—The *Ohmer Corporation*, Dayton, Ohio, has been purchased by the *Rockwell Manufacturing Company*, Pittsburgh, Pa., and will be operated under its present name as a wholly-owned subsidiary. *J. Allen Harlan*, president of Ohmer for the past year, will remain with the new ownership as vice-president.

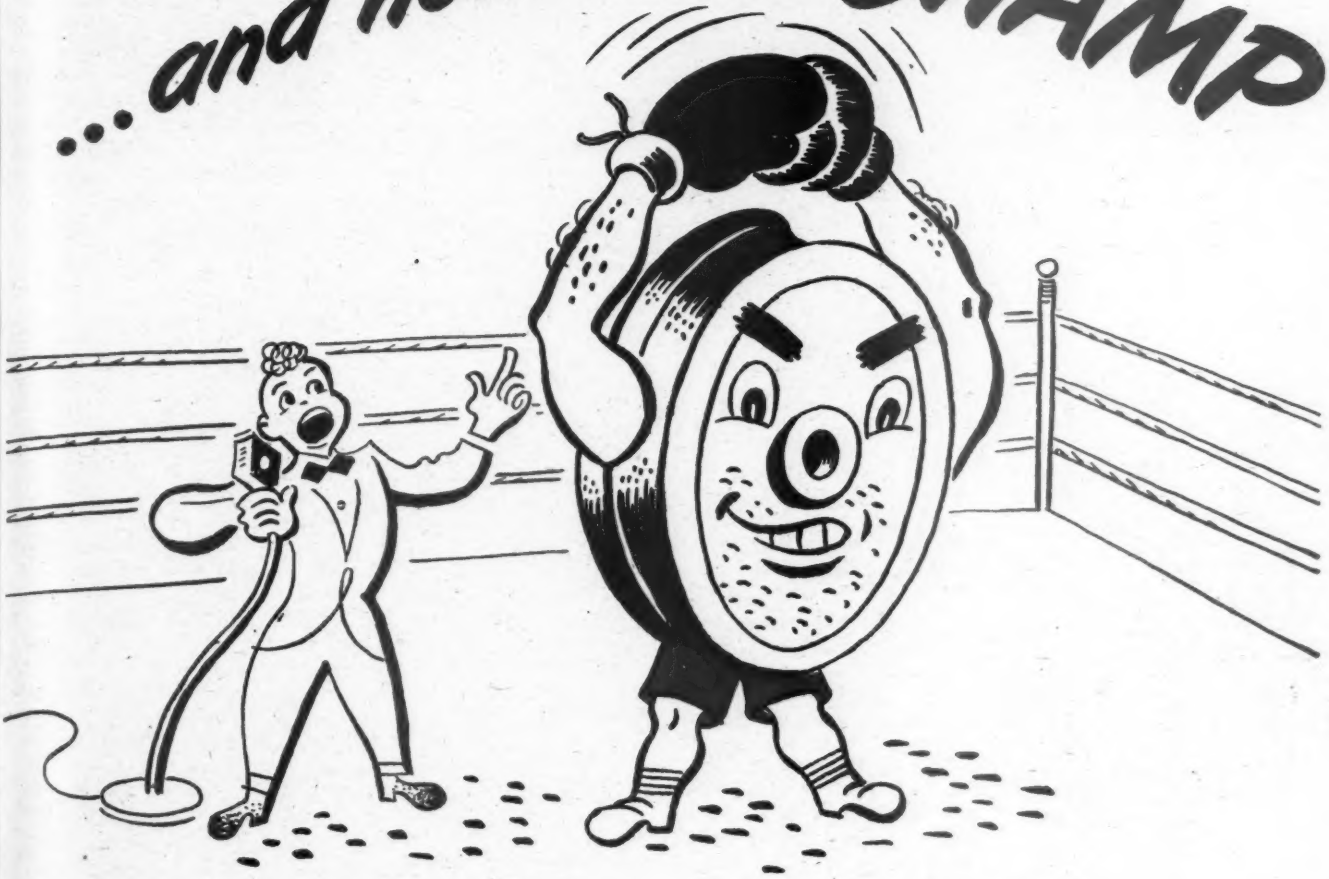
◆

TRANSPORT PRODUCTS CORPORATION.—*Carl G. Howard*, 307 North Michigan avenue, Chicago, has been appointed representative for the Transport Products Corporation, in the Chicago, Milwaukee, Wis., and Minneapolis, Minn.-St. Paul areas.

◆

PRECO INCORPORATED.—*C. W. Workman* has been appointed manager of the Chicago district office of Preco Incorporated. Mr. Workman, for the last five years was as-

...and now THE CHAMP



In this corner, weighing 750 pounds and wearing red trunks . . . from the finest wheel manufacturing plants of the United States and Canada . . . that husky warrior and champion of the rails, freight transportation's own Tough Guy — the Chilled Car Wheel!

Our job at the Association of Manufacturers of Chilled Car Wheels is to see to it that The Tough Guy gets tougher all the time.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS
445 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.
American Car & Foundry Co. • Canadian Car & Foundry Co. • Cleveland Production Co. Griffin Wheel Co. • Marshall Car Wheel & Foundry Co. • Maryland Car Wheel Co. • New York Car Wheel Co. • Pullman-Standard Car Mfg. Co. • Southern Wheel (American Brake Shoe Co.)

sistant manager of the refrigerator department of the Atchison, Topeka & Santa Fe, with which road he had been since 1916.

◆

JOHNS-MANVILLE SALES CORPORATION.—*Francis J. Wakem* has been appointed vice-president of the Johns-Manville Sales Corporation. Mr. Wakem will continue also as merchandise manager of the industrial products division.

◆

PITTSBURGH STEEL COMPANY.—*Carl L. Zak*, assistant sales manager of the Pittsburgh Steel Company since April, 1945, has been appointed general manager of sales. *L. A. Ver Bryck* has been appointed assistant general manager of sales, and *Joseph G. Smith*, district sales manager at Pittsburgh, Pa., has been appointed manager of sales for the New York district,

Carl L. Zak

to succeed Mr. Ver Bryck. *Walter D. Schlundt*, former district sales manager at Detroit, Mich., will succeed Mr. Smith at Pittsburgh and *Edward L. Dull*, formerly at the Chicago office, has been appointed Detroit district sales manager. *Robert W. Mullin* has been appointed assistant district sales manager in the home office at Pittsburgh.

◆

VANADIUM CORPORATION OF AMERICA.—The Vanadium Corporation of America has announced the appointment of *Harry E. Orr* as general manager of operations of its Bridgeville, Pa., and Niagara Falls, N. Y., plants.

◆

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY.—As part of its $4,000,000 expansion program, the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., has announced the leasing of a two-story building for the company's enlarged sales school and research department.

◆

AMERICAN WHEELABRATOR & EQUIPMENT CORPORATION.—The name of the *American Foundry Equipment Company*, Mishawaka, Ind., has been changed to *American Wheelabrator & Equipment Corporation*.

◆

ELECTRIC STORAGE BATTERY COMPANY.—The Electric Storage Battery Company has purchased from the War Assets Administration for $1,000,000 a Chicago war plant, which they will convert for manufacturing Exide batteries.

FORMICA INSULATION COMPANY.—The *Formica Insulation Company*, Cincinnati, Ohio, has opened a factory sales office at 3606 Commerce street, Dallas, Texas, under the management of *Morton F. Harvey*, formerly of the sales office in Chicago. *Edward Brown*, who has recently returned from military service, has rejoined the Chicago sales office.

◆

NATIONAL TWIST DRILL & TOOL COMPANY.—The National Twist Drill & Tool Co. has removed all manufacturing facilities to Rochester, Mich. A new building addition just completed, houses the operations formerly performed at the company's Detroit plant. A stockroom and office is still maintained in Detroit at East Grand Boulevard and Brush street. Customers outside Detroit should communicate directly with the company's main office in Rochester.

◆

WALTER A. DEEMS COMPANY.—*M. H. Roberts* has been appointed vice-president of the Walter A. Deems Company, dealers in railroad and industrial equipment and supplies. Mr. Roberts was formerly vice-president in charge of engineering and technical adviser to the sales department of the Franklin Railway Supply Company. During his long career with that company he also served as consulting engineer to the United States government, as chairman of the Board of Helium Engineers, and chairman of the government committee for the study of the production of cheap oxygen and its possible use in metallurgical work. In 1935 he spent some time in Europe studying turbine-driven locomotives and investigating the possibilities of poppet-valve steam distribution for steam locomotives, especially the work of Andre Chapelon. Before joining Franklin Railway Supply, Mr. Roberts served for over three and

M. H. Roberts

one half years as chief engineer, automotive division, of the American Locomotive Company. For four years he was with the Air Reduction Company, for which he served as chief engineer, production manager, and sales assistant. He developed and built many of the Air Reduction plants and their equipment, including the oxygen and nitrogen plants operated by the government in World War I and one of the three experimental plants in Texas for the production of helium.

INTERCHEMICAL CORPORATION.—Interchemical Corporation has announced the transfer of the business and personnel of *Scriver & Quinn, Inc.*, a west coast subsidiary, to two other divisions. Scriver & Quinn's industrial finishes will be sold by the finishes division and their consumer products will be marketed by Interchemical Corporation-Scriver & Quinn Finishes.

◆

FAIRBANKS, MORSE & CO.—*Frederick J. Lindauer*, formerly assistant manager, has been appointed manager of Fairbanks, Morse & Co.'s Washington, D. C., office, to succeed the late Robert E. Post.

Frederick J. Lindauer joined Fairbanks, Morse in 1923 at the Three Rivers, Mich., plant. In 1925 he was appointed sales and application engineer, with headquarters at Baltimore, Md., and from 1926 to 1931 served as inspection engineer under the director of engineering for the company's factories in Beloit, Wis. Three Rivers, and Indianapolis, Ind. He later spent several years in the Chicago office; in 1933 was appointed sales engineer for the New York branch, and in 1935 was transferred to the Washington office.

The capacity of the Beloit (Wis.) works of Fairbanks, Morse will be increased soon by the erection of a new one-story building for construction of Diesel-electric locomotives ranging in size from 1,000-hp switchers to 8,000-hp road units, C. H. Morse, III, vice-president in charge of manufacturing, has announced. The new plant will be 163 ft wide by 703 ft long and 54 ft high to accommodate locomotive assembly machinery, including electric traveling cranes.

◆

WATSON-STILLMAN COMPANY.—*C. Huising*, formerly sales engineer for the Watson-Stillman Company, has been appointed New England representative for the firm.

◆

PITTSBURGH PLATE GLASS COMPANY.—*James G. Mowry*, industrial salesman for the Pittsburgh Plate Glass Company's paint division, has retired. Mr. Mowry was associated with the company for 45 years.

◆

UNION ASBESTOS & RUBBER CO.—The Union Asbestos & Rubber Co. has announced the abolishment of the office of chairman of the board. *J. H. Watters*, president, will assume the duties formerly exercised by the chairman of the board. *John H. Balch*, formerly secretary and treasurer, has been elected executive vice-president, retaining the position of treasurer, and *Stephen S. Steel*, formerly assistant secretary, has been elected secretary.

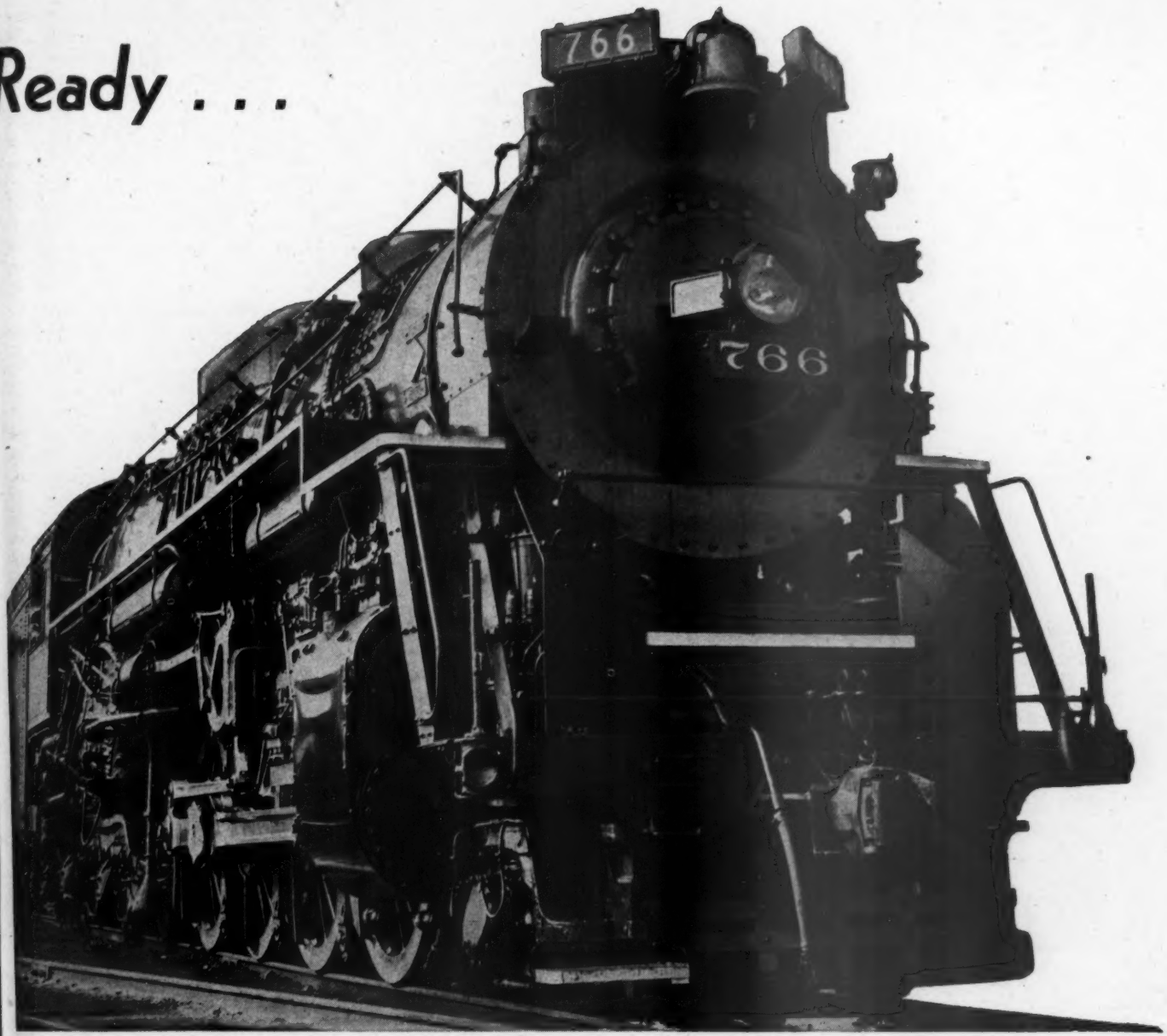
◆

INDEPENDENT PNEUMATIC TOOL COMPANY.—The Independent Pneumatic Tool Company of Chicago, has announced a $1,000,000 expansion of its main plant at Aurora, Ill. Construction of the annex, which will provide 85,000 sq. ft. of additional floor space for production purposes, will begin shortly.

◆

TERMINAL MANUFACTURING & SUPPLY CO.—The Terminal Manufacturing & Supply Co., Cleveland, Ohio, has been appointed by the Menasco Manufacturing Company,

Ready . . .



to meet the demand for higher speeds at lower costs

The Nickel Plate's enviable record of handling heavy freights on long runs at sustained high speeds has been partially made possible through its fleet of fifty-five modern Lima-built 2-8-4 steam locomotives which this far-sighted railroad has placed in service during the last five years.

LIMA LOCOMOTIVE WORKS — LIMA LOCOMOTIVE WORKS INCORPORATED — INCORPORATED, LIMA, OHIO

Burbank, Calif., as exclusive sales representative for Malabar hydraulic railroad jacks and tools, in Ohio, Indiana, Illinois, western New York, western Pennsylvania and Michigan.

◆

DURAMETALLIC CORPORATION OF NEW JERSEY.—*Herbert M. Lewis*, vice-president and general manager of the Durametallic Corporation of New Jersey, with headquarters at Newark, N. J., has retired.

◆

AMERICAN TIRE & RUBBER CO.—*Waterhouse & Co.*, 50 Church street, New York, have been appointed sales agents in the railroad field for the American Tire & Rubber Co. of Trenton, N. J.

◆

LUKENS STEEL COMPANY.—*Willard K. Fohl* has been appointed manager of the railroad division of the Lukens Steel Company and its subsidiaries, the By-Products Steel Corporation and Lukenweld, Inc., Coatesville, Pa.

Willard K. Fohl joined Lukens in 1937, serving in the research and openhearth

Willard K. Fohl

departments until 1939, when he was appointed assistant research metallurgist. During World War II, he served with the United States Navy, returning to Lukens in November, 1945. Mr. Fohl is a member of the New York Railroad Club and of the Master Boiler Makers' Association.

◆

TURCO PRODUCTS, INC.—*L. H. Moulton* has been appointed national sales director, and *D. T. Buist*, assistant national sales director, of *Turco Products, Inc.*, Los Angeles, Calif.

◆

KOPPERS COMPANY.—Koppers Company has announced the following appointments in the wood preserving division: *Walter P. Arnold*, formerly manager of the technical department of the division, has been appointed assistant to the vice-president in charge of railroad sales, and *J. M. Irvine*, formerly district sales manager in New York, has been appointed assistant to the vice-president in charge of commercial sales, both with headquarters in Pittsburgh, Pa. *R. H. Bescher*, formerly a member of the technical staff of the division, has been appointed manager of the technical department, with headquarters in Orrville, Ohio.

PRESSED STEEL CAR COMPANY.—*H. E. Chilcoat*, vice-president in charge of the Pressed Steel Car Company, has been elected vice-president in charge of domestic industrial and railway sales.

H. E. Chilcoat began his career as a machinist apprentice in the employ of the Pennsylvania. He joined the Westing-

H. E. Chilcoat

house Air Brake Company in 1906; the Clark Car Company in 1918, and from 1926 to 1928 was engaged in special consulting work. He was appointed sales manager, air dump car division, of the Koppel Industrial Car & Equipment Co. in 1928, and in 1931, general manager of sales of Pressed Steel Car's industrial division. In April, 1946, Mr. Chilcoat was elected vice-president in charge of production.

◆

AMERICAN CAR AND FOUNDRY COMPANY.—*J. D. Seiler*, general superintendent of the Milton, Pa., plant of the American Car and Foundry Company, has been appointed assistant works manager at the Milton plant.

J. D. Seiler was born and educated in Brooklyn, N. Y., where he studied engineering at the Pratt Institute. He joined

J. D. Seiler

the New York engineering department of American Car and Foundry in 1907 and subsequently served in the mechanical engineering department at Berwick, Pa., and in the export inspection department. In 1916, he was appointed chief inspector at the Milton plant and in 1926 became general superintendent.

O. W. SWANSON CORPORATION.—*Henry W. Stahl* has been appointed eastern and southern sales representative for the *O. W. Swanson Corporation*, Chicago, with headquarters in New York.

◆

LINK-BELT COMPANY.—The Link-Belt Company, Chicago, has opened a sales office at 808 North Third street, Milwaukee 3, Wis. *William M. Hufnagel*, district sales manager, has been placed in charge of the new office, and will be assisted by *H. B. Johnson* and *F. E. Sweeney*.

◆

DAYTON RUBBER MANUFACTURING COMPANY.—*M. H. Clarke* has been appointed vice-president and director of manufacturing of the Dayton Rubber Company.

◆

REYNOLDS METALS COMPANY.—The Reynolds Metals Company has acquired the government-owned Newark, Ohio, aluminum rolling mill from the War Assets Administration.

◆

FRANKLIN RAILWAY SUPPLY COMPANY.—*John E. Long*, formerly general sales manager of the Franklin Railway Supply Company, New York, has been appointed

John E. Long

vice-president in charge of domestic sales.

John E. Long is a graduate of Purdue University (1923) with a degree in mechanical engineering. He joined the Lima Locomotive Works upon graduation and served in the calculating, service, engineering and sales departments. He entered Franklin's Chicago office in 1934; was appointed western sales manager in 1939, and general sales manager in 1944.

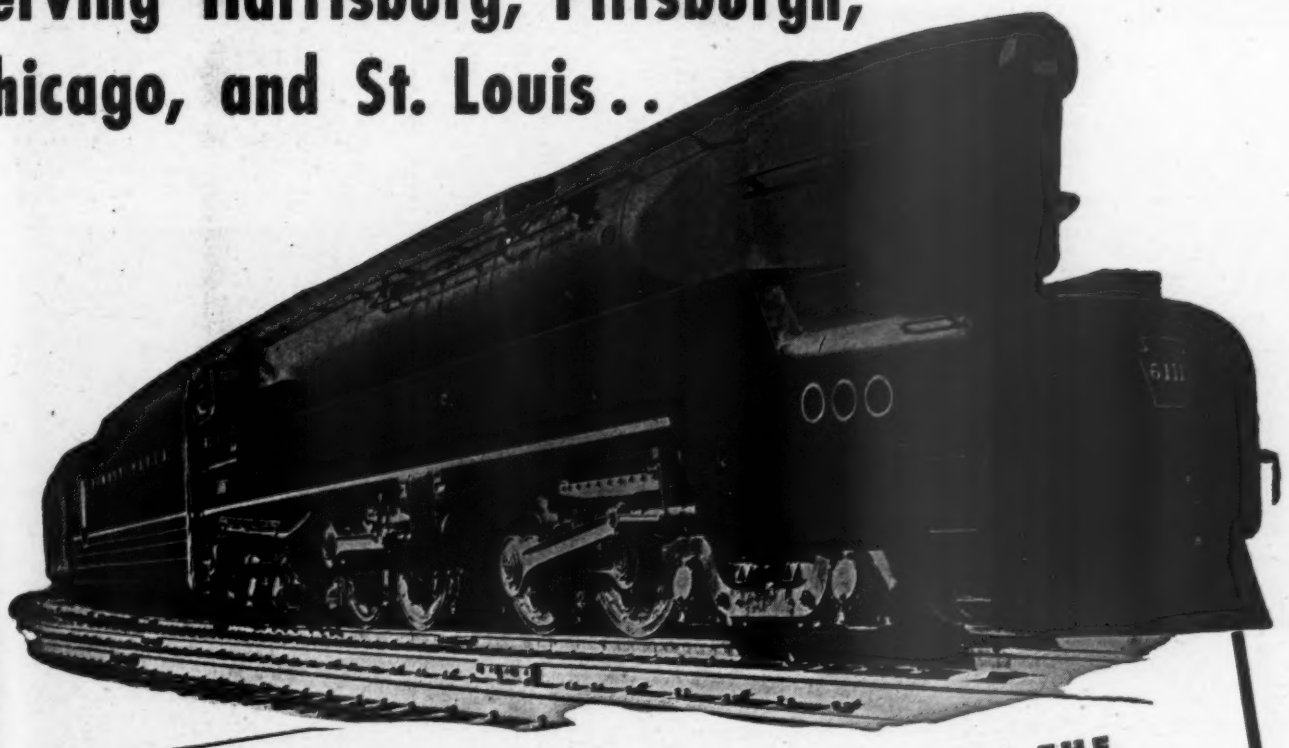
◆

AIR REDUCTION SALES COMPANY.—*Ray L. Rex* has been appointed general superintendent of railroad service for the Air Reduction Sales Company, with headquarters in New York. He will report to G. V. Slottman, manager of the technical sales division.

◆

PRIME MANUFACTURING COMPANY.—The Prime Manufacturing Company, Milwaukee, Wis., has acquired the locomotive soot blower and the pneumatic bell ringer formerly manufactured by the Superior Products Corporation. All equipment and machinery is being transferred from the Superior plant in Pittsburgh, Pa., to plants of the Prime Company.

Serving Harrisburg, Pittsburgh, Chicago, and St. Louis . .



THESE ARE THE TRAINS
HANDLED BY LOCOMOTIVES EQUIPPED WITH THE

Franklin System of Steam Distribution

The Broadway Limited
The General
The Admiral
Manhattan Limited
Liberty Limited
The Trail Blazer
The Pennsylvanian
The Rainbow
Pennsylvania Limited
Gotham Limited
Spirit of St. Louis
The American
The New Yorker
The Metropolitan
The Jeffersonian
The St. Louisan
The Golden Triangle
The Clevelander
Cincinnati Limited
The Red Arrow
The Steel King
The Pittsburgher
The Sunshine Special
The Golden Arrow
The Duquesne
The Akronite
The Statesman
The Juniata

The 52 locomotives, Pennsylvania Class T1, are of the type that developed 6552 indicated horsepower on test; that achieved a water rate of 13.6 pounds at 76 mph, 20-per-cent cutoff; that produced nearly maximum power at 15-per-cent cutoff. They have consistently shown capacity to maintain speeds of 100 miles per hour, with trains of 14 and 16 cars, on test runs. In no small measure, the Franklin System of Steam Distribution has played a part in achieving these results.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

New Carbonized Oil Cleaner for All Diesel Parts

Diesels have one thing in common with airplane engines—their carbonized oil deposits are stubborn and difficult to remove by ordinary methods.

The success of Magnus 755 when it was perfected for use by the Army Air Forces on reconditioning operations during the war, led to extensive tests on diesel engine parts cleaning when it was released for commercial use. Results have been uniformly striking.

Used to soak-clean parts #755 speedily penetrates carbonized oil deposits, loosening their bond with the metal. After the short soaking period, parts are removed and flushed clean with water or safety solvent. The dirt doesn't get into the #755, which remains fresh and active over a long service life. Hand work is eliminated.

In railroad work, where many varied sized elements are to be cleaned at a high production rate, the Magnus Aja-Dip Cleaning Machine greatly speeds the cleaning rate of Magnus 755.

Large Diesel Manufacturer Adopts Magnus 755

After exhaustive tests, one of the outstanding manufacturers of locomotive diesel engines has fully approved Magnus 755 for cleaning carbonized parts and will recommend the use of this cleaner in the operating manual issued by that corporation.

Small Machine Cleans 1 Ton of Parts per Shift

As an example of what a Magnus Aja-Dip Cleaning Machine can do in a railroad shop, the accompanying illustration is interesting. The machine is a 600-lb. capacity unit. But it cleans a load in about two hours on the average, so that in an 8-hour shift it cleans over a ton of parts.

The machine is operated 16-20 hours a day, seven days a week, on a wide variety of small steam and diesel locomotive parts. The user says that they have cleaned as many as 36 different kinds of parts in one load.

Safe Hand Cleaner Cuts Lost Time

Innumerable investigations of the causes of lost time in industry have shown that the use of harsh, chemically active hand cleaners is back of the high percentage of skin infections in the picture. Magnus Hand Cleaner, mild in composition, safe in its scouring action and highly satisfactory in cleaning speed and action, will eliminate this cause of lost time in your shops.

Safe Degreasing of Dirty Machinery

Use of gasoline, benzine and other volatile and flammable solvents to clean shop machines of grease and dirt is still far too common for safety.

It is easy to clean such machines in complete safety and comfort with Magnusol. One part of this concentrate is mixed with 8 parts kerosene or safety solvent. This mixture, at room temperature, is sprayed, brushed or sponged on all surfaces to be cleaned, and allowed to soak in. After 15 minutes the machine is flushed clean with tap water under pressure. All grease, oil and dirt are flushed away, leaving completely clean surfaces. Harmless to all metals and materials of construction.

Magnus Railroad Cleaners & Machines

MAGNUS CHEMICAL COMPANY · 77 SOUTH AVE., GARWOOD, N. J.

Service Representatives in Principal Cities

IN CANADA — MAGNUS CHEMICALS, LTD., 4040 RUE MASSON, MONTREAL 36, QUE.

NATIONAL MALLEABLE & STEEL CASTINGS CO.—*Ray E. Valentine,* sales agent at the St. Louis, Mo., railway sales office of the National Malleable & Steel Castings Co., has been appointed assistant district sales manager at St. Louis. *John R. Kingman* succeeds Mr. Valentine as sales agent.

Ray E. Valentine has been associated with National Malleable since 1913. During World War II, he was chief of the

Ray E. Valentine

malleable iron section, forgings and castings branch, of the War Production Board. He returned to National Malleable in 1945 as St. Louis railway sales agent.

John R. Kingman joined National Malleable's engineering department at Cleve-

John R. Kingman

land, Ohio, in 1945, after five years' service in the United States Army. He later was transferred to the St. Louis office as field engineer.

◆

UNITED STATES RUBBER COMPANY.—*Edwin D. Meade* of Washington, D. C., has been appointed manager of railway sales at the Chicago branch of United States Rubber Company. *L. Phil Haser,* who has handled the company's railroad sales in the Chicago district since 1903, will serve in a consulting capacity to Mr. Meade.

Edwin D. Meade was born on Long Island and educated at William & Mary College. He has been associated with the rubber company since 1935. He started as a clerk in the company's New York

Record of GM Diesels on Atlantic Coast Line

Locomotive Number	Month Delivered	Miles Operated	Miles Assigned	Per Cent Availability
500	11-39	1,422,391*	1,492,193	95.3
501	11-39	1,337,677*	1,445,476	92.5
502	11-40	1,262,239*	1,286,296	98.1
503	11-40	1,181,882*	1,222,250	96.7
504	11-40	1,205,601*	1,261,597	95.6
505	11-40	1,314,140*	1,349,702	97.4
506	11-40	1,200,676*	1,226,764	97.9
507	11-40	1,145,648*	1,186,921	96.5
508	12-40	1,279,680*	1,371,517	93.3
509	12-40	1,140,673*	1,228,823	92.8
510	12-40	1,162,645*	1,189,365	97.8
511	12-40	1,188,101*	1,257,202	94.5
512	12-40	1,227,639*	1,291,814	95.0
513	1-41	1,147,919*	1,268,667	90.5
514	1-41	1,148,386*	1,194,946	96.1
515	1-41	1,096,603*	1,148,338	95.5
516	1-42	887,526	931,119	95.3
517	1-42	886,823	976,261	90.8
518	3-42	833,170	871,875	95.6
519	3-42	835,878	894,840	93.4
520	3-42	927,468	996,879	93.0
521	3-42	790,189	836,286	94.5
522	4-42	807,526	835,653	96.6
523	4-42	800,606	885,546	90.4
524	3-45	294,447	297,467	99.0
525	3-45	291,961	298,080	97.9
526	4-45	278,048	286,535	97.0
527	4-45	285,584	294,740	96.9
528	4-45	257,606	272,526	94.5
529	6-45	234,432	237,032	98.9
530	8-45	203,606	213,982	95.2
531	8-45	195,787	202,751	96.6
532	6-46	44,101	44,771	98.5
533	6-46	40,604	43,914	92.5
534	6-46	45,360	46,030	98.5
535	6-46	43,278	43,948	98.5
536	6-46	43,329	43,999	98.5
537	6-46	42,967	43,637	98.5
750	11-40	1,204,068*	1,245,149	96.7
751	12-40	1,234,785*	1,320,320	93.5
752	1-41	1,056,473*	1,171,221	90.2
753	1-41	1,215,104*	1,244,749	97.6
754	1-42	996,568	1,022,082	97.5
755	3-45	257,690	276,786	93.1
756	4-45	287,624	287,624	100.0
757	4-45	257,351	270,044	95.3
758	4-45	255,881	265,110	96.5
759	6-45	241,269	241,269	100.0
760	6-45	221,007	223,607	98.8
761	8-45	194,712	198,040	98.3
762	8-45	196,483	205,483	95.6
763	8-45	210,566	210,566	100.0
764	8-45	172,123	180,014	95.6
	Total	36,533,900	38,381,806	95.2

* "Veterans" are locomotives with over 1,000,000 miles' service.

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
LA GRANGE, ILL.

BEATTY MACHINE
& MFG. CO.
Hammond, Ind.

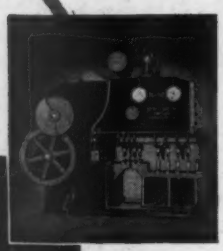
This Name

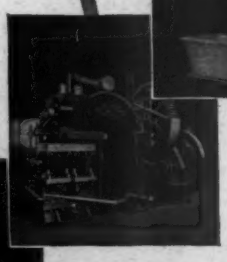
ON A MACHINE MEANS-

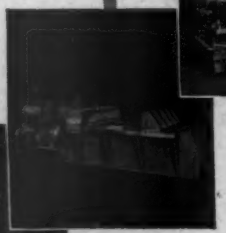
ADVANCED DESIGN
Keen engineering minds, close to the problems of the metal working industry, can help solve your problems with machines that bear the BEATTY name-plate. Talk to BEATTY before you buy.

FINE PERFORMANCE
Matching their modern engineering, are the finest materials, the top quality craftsmanship that goes into the building of BEATTY machines. That name stands for speed, accuracy, durability, low up-keep.

A COMPLETE LINE
Consult us for hydraulic and mechanical punches, presses, shears, pipe benders, bulldozers, coping machines, extrusion presses and spacing tables.







Write—

Write for information on the complete Beatty line of mechanical and hydraulic punches, presses, spacing tables, bulldozers, extruding presses.

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

branch and became a salesman a few months later. Since 1941 he has been located in Washington, D. C.

◆

SHAKEPROOF, INC.—Shakeproof, Inc., a division of the Illinois Tool Works, has announced the following personnel changes: *Eugene W. Fuller* has been appointed manager of the division. *B. F. Bales*, formerly assistant sales manager, succeeds Mr. Fuller as sales manager. *Russell H. Maude* has been appointed sales manager of the Detroit (Mich.) district, to succeed *John B. O'Connor*, who has replaced *Walter M. Hanneman* as chief engineer. Mr. Hanneman has joined the SEMS License division as chief engineer.

◆

MARVEL EQUIPMENT COMPANY.—*J. N. Thorp* has joined the sales staff of the Marvel Equipment Company, in charge of eastern sales as far west as Buffalo, N. Y. He will maintain his office in New York.

◆

UNITED STATES STEEL CORPORATION.—*Dr. Robert H. Aborn* has been appointed assistant director of research laboratory of the United States Steel Corporation, at Kearny, N. J. *Harry E. Lorenz*, assistant purchasing agent of the Chicago district, has been appointed purchasing agent of the affiliated Carnegie-Illinois Steel Corporation, with headquarters at Pittsburgh, Pa. *C. H. Baringer* and *F. G. Buchheit* have been appointed assistant purchasing agents.

◆

ERIE FOUNDRY COMPANY.—*Harry A. Trishman* has been appointed manager of the Hydraulic division of the Erie Foundry Company, Erie, Pa. Mr. Trishman was previously chief engineer of the Adamson United Company.

◆

LODGE & SHIPLEY COMPANY.—The *Lodge & Shipley Machine Tool Co.*, because of the broadened scope of its manufacturing operations, has changed its name to the *Lodge & Shipley Co.*

The Lodge & Shipley Company has acquired the turret-lathe and hand-screw-machine business of the *Acme Machine Tool Company*, also of Cincinnati, the companies have jointly announced.

Obituary

LOUIS R. MILLAR, 69, who retired in 1945 as a sales engineer for the Mercury Manufacturing Company, Chicago, died at his home in Los Angeles, Calif., on December 19.

◆

ALBERT W. JACOBS, former chairman of the board of the Star Headlight & Lantern Co., with which company he was associated for over 54 years, died on November 13, after a long illness. He was 72.

◆

C. D. YOUNG, sales manager, welding division, *Metal & Thermit Corp.*, New York, died on November 16 at Orange, N. J.

◆

SYDNEY G. MCALLISTER, who retired in 1940 as president of the International Harvester Company, died in Pasadena, Calif., on December 25, after a lengthy illness. Following his retirement, Mr. McAllister continued as chairman of the firm's execu-

Yes, your passenger wants swift transportation—but he also wants *comfort*. And comfort begins with brakes!

HSC Electro-Pneumatic Brakes—with the safety of adequate braking forces, speed of electric control, and smoothness of simultaneous brake action—are the brakes which answer every comfort and efficiency requisite!

At the same time, those features which contribute so much to passenger comfort have an economic value to your railroad. They help trains reach their destinations faster. Thus, track capacity is increased and availability of rolling equipment improved. By affording modern comfort for your passengers, they attract more of them to your services. In eliminating slack action they help eliminate wear on your rolling equipment, thereby reducing maintenance costs.

Thus, every feature of HSC Electro-Pneumatic Brakes has a double edge—one for your fight for patronage, the other for your battle against costs.

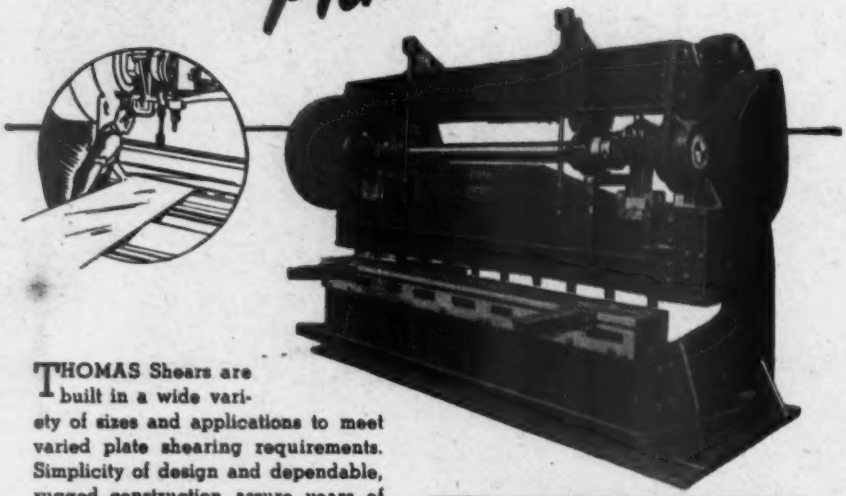
Specify these three Westinghouse aids to better railroading: *HSC Electro-Pneumatic Brakes* . . . for braking flexibility to match modern train speeds, and unequalled smooth action. *Speed Governor Control* . . . for regulating braking forces to wheel speeds. *AP Decelostat* . . . for wheel slip detection to keep the wheels rolling.

Brakes are Basic to Railroad Progress

Westinghouse Air Brake Co.

WILMERDING, PA.

THOMAS
MILL TYPE Plate Shears



THOMAS Shears are built in a wide variety of sizes and applications to meet varied plate shearing requirements. Simplicity of design and dependable, rugged construction assure years of maintenance-free operation. *Write for Bulletin 126.*

THOMAS
MACHINE MANUFACTURING COMPANY
PITTSBURGH, 23, PA.

6

If you have a SPECIAL PROBLEM

in any of these operations, where precision work is demanded and where greater production at man-hour savings is paramount—

• BORING—rough, semi-finish and finish • MILLING (special types) • STRAIGHT LINE DRILLING • UNIVERSAL ADJUSTABLE SPINDLE DRILLING • HONING • TAPPING • REAMING • COUNTERBORING • VERTICAL AND WAY-TYPE EQUIPMENT . . .

then a Moline Multiple Spindle Specially Designed machine tool is your answer. Moline tools are ruggedly built and engineered to fit your PARTICULAR requirements, they're made to last for years, they're easy to change over to other jobs, they do better work at less cost and stand up to it longer.

For YOUR special problem, go "HOLE-HOG," write us for any information you may need.

MOLINE TOOL CO.
HOLE-HOG
MOLINE, ILLINOIS

MOLINE TOOL COMPANY
100 20th Street Moline, Illinois

105 (Adv. 70)

tive committee until two years ago, when he relinquished the position because of ill health.

◆

WARREN G. FERGUSON, recently retired transportation sales engineer for the General Electric Company, died on December 13, at Riverside, Ill. He was associated with the company for 36 years.

◆

JOHN W. BRAY, 79, a director of the Bullard Company, machine tool plant, died January 4 after a long illness. Mr. Bray came to the Bullard Company as an apprentice in 1884, became a director in 1930, and was appointed vice-president in charge of sales in 1932.

◆

DEWITT R. ARNOLD, senior vice-president of the Standard Railway Equipment Company, died on December 21. Mr. Arnold was 61 years old. He joined Standard Railway Equipment in 1924 at the Chicago office, holding the position of vice-president until 1936, when he joined the Chicago-Hutchins Company as its president. In 1939 he returned to Standard Railway Equipment as senior vice-president, with headquarters in New York.

◆

EDWIN STRASSBURGER, St. Louis, Mo., representative for the Buffalo Brake Beam Company, whose death was reported in the December issue, was born in St. Louis on September 20, 1869. He attended the public schools of that city and the Washington University Manual Training School. He began his career with the Bank of Commerce in St. Louis, where he later joined the United Railways. In 1903, he became associated with the Damascus Brake Beam Company and three years later joined the Buffalo Brake Beam Company.

Personal Mention

General

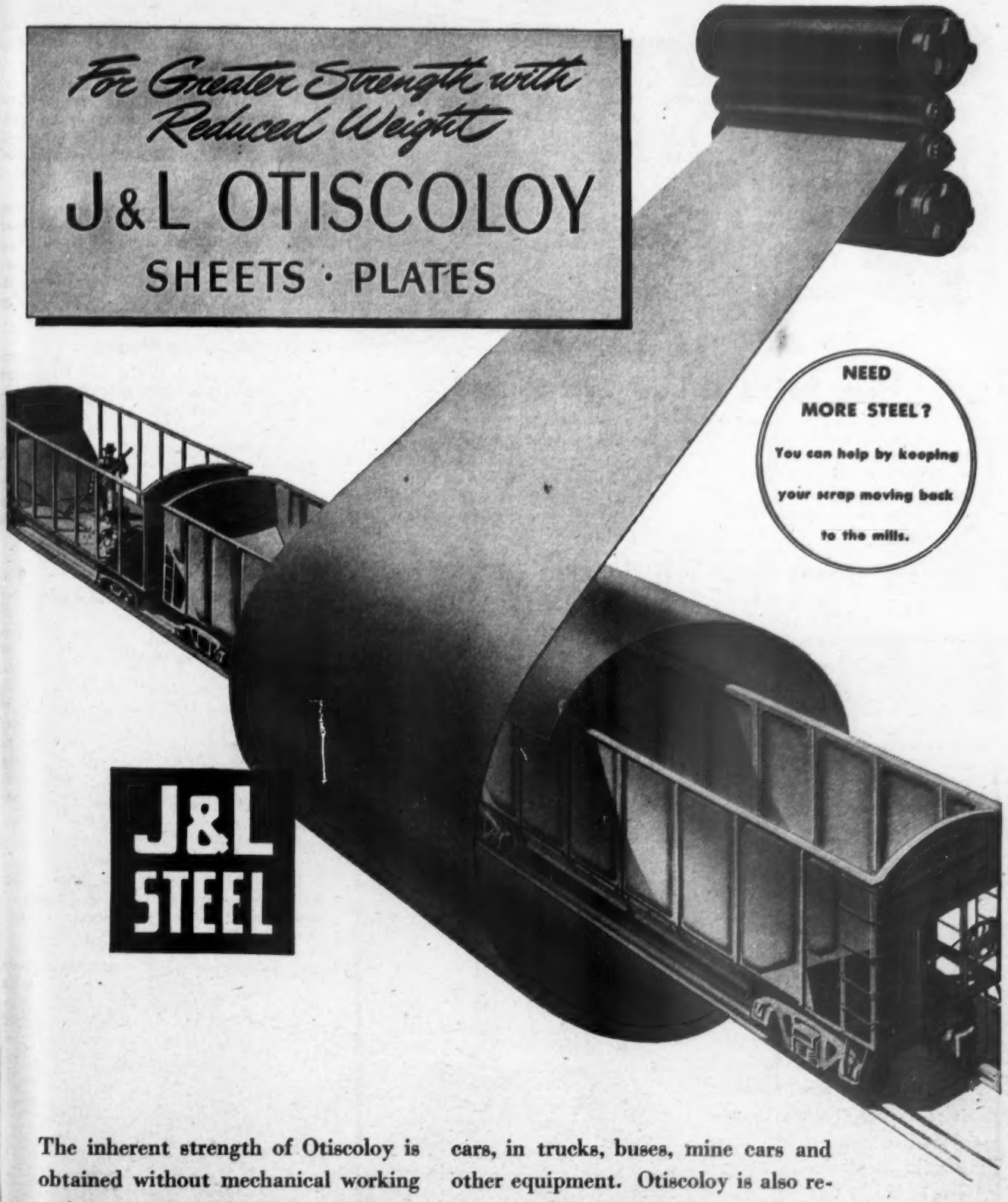
GEORGE E. BENNETT, whose appointment as superintendent of motive power of the Chicago & Eastern Illinois, with headquarters at Danville, Ill., was reported in the January issue, was born on September 9, 1904, at Flandreau, S. D. He entered railroad service with the C. & E. I.

George E. Bennett

For Greater Strength with Reduced Weight

J&L OTISCOLOY

SHEETS · PLATES



The inherent strength of Otiscoloy is obtained without mechanical working or heat treating, which gives it exceptional weldability and formability for a high-tensile steel. It is being used successfully to reduce dead-weight and increase pay load in railroad freight cars, in trucks, buses, mine cars and other equipment. Otiscoloy is also resistant to abrasion and corrosion. Our metallurgical engineers will be glad to discuss the application of Otiscoloy to your production problems. Write for further information.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PA.

High Speed at Low Cost No. 4B

For tool room, stock room, or maintenance shop, this 6" x 6" capacity hack saw is superior to anything in its price class. Embodies similar design principles and features of MARVEL Heavy Duty production saws. Cuts a 2" standard pipe in 30 seconds—a 5" round piece of machine steel in 8 minutes!

2-Speed and 4-Speed for applications where materials of different hardness and alloy characteristics are to be cut. MARVEL 4B is available in 2-Speed and 4-Speed models. Built-in work tracks for holding outer end of bars are also available for all models.

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE, CHICAGO 39, U.S.A.

ROUSTABOUT CRANE

You save valuable man-hours and avoid costly delays when you mechanize your plant and yard with this tractor-footed load-hustler. Hook, magnet —loads to 7½ tons. Flexible performance, built for years of overwork. Write today for cost-cutting facts.

THE HUGHES-KEENAN COMPANY

608 NEWMAN STREET . . . . MANSFIELD, OHIO

ROUSTABOUT CRANE

Roustabout Cranes

By Hughes-Keenan

Load-Handling Specialists Since 1904

in 1922 as a machinist helper at Danville, became a machinist in 1924, and assistant enginehouse foreman in 1937. He served as night enginehouse foreman at St. Louis, Mo., and Danville during 1938, and was appointed day enginehouse foreman in 1941. The following year he became foreman back shop at Danville; in 1943 was shop superintendent, and in 1943 master mechanic at Villa Grove, Ill.

CLARK W. MILSPAUGH, mechanical engineer of the Michigan Central at Detroit, Mich., has retired after more than 37 years of service with that road.

B. J. PEASLEY, superintendent of motive power of the St. Louis Southwestern of Texas at Tyler, Tex., has retired after 30 years of service with the road.

P. H. JENNER, road foreman of engines of the Western Pacific, with headquarters at San Francisco, Calif., has been appointed assistant to general manager, with headquarters at San Francisco.

E. V. MEYERS, general locomotive foreman of the St. Louis Southwestern of Texas, at Tyler, Tex., has been appointed superintendent of motive power, with headquarters at Tyler.

PAUL H. VERD, whose appointment as superintendent of motive power and equipment of the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill., was reported in the January issue, was born on April 30, 1908, at Arlington, Wash. He is a graduate of the University of Washington (1931) with a B. S. degree in electrical engineering. In the summer of 1929 Mr. Verd worked as a surveying party axman for the Sultan Railway & Timber Co., and while completing his college studies, served part-time as a street-car operator on the Seattle Municipal Street Railway. He continued in that position until 1933. Also, while employed part-time by a Seattle engineer during 1932, he worked on the development of a method of detecting transverse fissures in rails. In 1933 he became a

Paul H. Verd

student engineer in the employ of the General Electric Company at Schenectady, N. Y., and Erie, Pa., specializing in electric and Diesel-electric motive power. Mr. Verd joined the Electro-Motive Division of General Motors Corporation in 1935 as service engineer (Diesel motive power) at

MANAGEMENT and PRODUCTION men want

FACTS

about equipment they buy

Here are FACTS about

Coffing Hoists

"SAFETY-PULL"
Ratchet Lever Hoists

For all kinds of construction and maintenance work, wherever a lift or pull is needed, there is a "Safety-Pull" to meet your requirements. SAFE, DURABLE, DEPENDABLE. Capacities range from ¾ to 15 tons, yet they weigh only 14 to 150 pounds.

"QUIK-LIFT"
Electric Hoists

For dependable and economical service the "Quik-Lift" incorporates EFFICIENCY with SPEED, POWER and DURABILITY. Just plug it in and speed up production. Capacities from 500 to 4000 pounds with lifting speeds from 4 to 49 feet per minute.

MODEL Y-C
Spur Geared Chain Hoists

Coffing Spur Geared Chain Hoists embody the planetary gear system with the Weston automatic brake. There are seven capacities ranging from ½ to 5 tons. A sturdy, dependable hoist for heavy work and in the production line.

Contact Your Supplier or Write for
BULLETIN H C-100

Coffing Hoist Co.
Danville, Illinois U. S. A.

LaGrange, Ill. He became associated with the E. J. & E. in 1937 as supervisor of Diesel locomotives. In 1941 he was placed on active duty in the Navy. He was awarded the bronze star for meritorious service in connection with submarine operations against the enemy, and attained the rank of commander prior to his release in September 1945. He then returned to the E. J. & E. as master mechanic at Gary.

E. ABRAHAM has been appointed assistant to superintendent of motive power and equipment of the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill.

CARL D. LOVE, general superintendent of the Louisville & Nashville, at Louisville, Ky., has been appointed assistant general manager with headquarters at Louisville. Mr. Love was born at Knoxville, Tenn., and began his railroad career there in 1909 in the mechanical department of the L. & N. Mr. Love's continuous service with the L. & N. dates from 1918 when he became a machinist at Covington, Ky. He was later night assistant engine-house foreman at Covington and day assistant engine-house foreman at DeCoursey, Ky. He was appointed assistant master mechanic at DeCoursey in 1925; master mechanic at Radnor, Tenn., in 1931, and superintendent of the

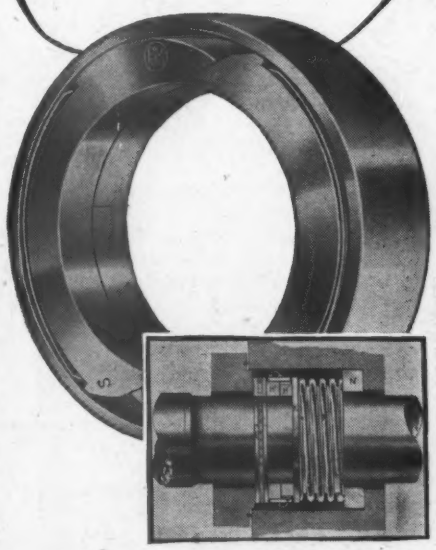
Carl D. Love

Louisville division in 1941. He was later furloughed to military service and as commanding officer of the 728th Railway Operating Battalion with the rank of lieutenant colonel, he served in the Cherbourg area of France and at Fuerth, Germany. He received the Legion of Merit and the Croix de Guerre with Palm for "exceptionally meritorious conduct in the performance of outstanding services." He was advanced to the rank of colonel in the U. S. Army Officer's Reserve on March 6, 1946. On August 1, 1945, following his separation from the Army, Mr. Love was appointed general superintendent.

GEORGE F. SHULL has retired as superintendent of machinery of the Clinchfield at Erwin, Tenn. Mr. Shull was born on April 19, 1876, at Woodstock, Va. He entered railroad service in 1890 as a messenger boy in the employ of the Shenandoah Valley (now the Norfolk & Western) at Shenandoah, Va. He served also as a call boy and yard clerk, and in 1893 became

Quality Proved

in thousands of locomotives . . . . over millions of miles traveled . . .



Performance proves! In nearly fifty years of service to the steam power field, P-M Metallic Rod Packing has earned its position of leadership. Its star performance in packing steam pressures is reflected in the selection of materials and application of expert, painstaking craftsmanship in manufacture. Each segment bears the Paxton-Mitchell "P-M" trade-mark and is made of selected metals which withstand the extreme pressures of today's operating conditions. Special composition metal segments available for super-heated steam.

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The Packing that Packs

Paxton-Mitchell Company
Engineers — Founders — Craftsmen
Omaha 5, Nebraska

Demonstrating
BRICKSEAL
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Brickseal provides a crackproof, vitrified armor for furnace linings. The small firebricks shown in the furnace were bonded and painted with Brickseal and heated to 2250°. Directly from the furnace they were plunged into cold water as shown below—a test for *any* material subject to expansion and contraction.

Brickseal is *semi-plastic when hot, yet hard and tough when cold.* Brickseal is made in grades suitable to heats ranging from 1400° to more than 3000°. It will make any furnace last longer by giving new life to your refractories. Write or call local dealer for a demonstration.

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5800 S. Hoover St., Los Angeles, Calif.
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a machinist apprentice. In April, 1897, he became a machinist on the Southern at Spencer; in September, 1897, a machinist on the Norfolk & Western at Roanoke, and in 1901, a machinist on the Pennsylvania at Altoona, Pa. He returned to the Norfolk & Western in 1902 as enginehouse foreman at Radford, Va. In 1904 he was transferred to West Roanoke, Va., as a foreman, and in 1906 became assistant erecting shop foreman at Roanoke. In 1911 he entered the employ of the Carolina, Clinchfield & Ohio (now the Clinchfield) as general foreman at Erwin. He was appointed master mechanic at Erwin in 1913; superintendent of motive power in January, 1924, and superintendent of machinery in December, 1924.

T. G. McFALL has been appointed superintendent of machinery, with jurisdiction over the mechanical department, of the Clinchfield, with headquarters at Erwin, Tenn.

Diesel

H. G. SCHAFFNER has been appointed a Diesel locomotive inspector for the New York Central System, with headquarters at New York.

H. LIEBERT has been appointed a Diesel locomotive inspector for the New York Central System, with headquarters at New York.

F. E. HESFORD has been appointed a Diesel locomotive inspector for the New York Central System, with headquarters at New York.

H. R. FRIEL has been appointed a Diesel locomotive inspector for the New York Central System, with headquarters at New York.

Car Department

WALTER A. EMERSON, general master car builder of the Elgin, Joliet & Eastern, has been appointed superintendent car department at Joliet, Ill. Mr. Emerson was born on October 8, 1881, at Marshalltown, Iowa, where he began his railway career

Walter A. Emerson

in 1900 in the car department of the Iowa Central (now Minneapolis & St. Louis). Mr. Emerson joined the E. J. & E. in 1901. He became assistant master car builder in 1917; master car builder in 1927, and general master car builder in 1938.

CLIFFORD H. WILSON, freight car foreman of the Missouri-Kansas-Texas at Denison, Tex., has been promoted to the position of general car foreman of the car shop at Denison.

Master Mechanics and Road Foremen

J. C. SHANNON, assistant master mechanic of the New York Central at Jackson, Mich., has been appointed master mechanic with headquarters at Detroit, Mich.

A. E. BECKMAN, assistant master mechanic of the Baltimore & Ohio at Cumberland, Md., has been promoted to the position of master mechanic.

R. S. GATES, assistant master mechanic of the New York Central, at Detroit, Mich., has been transferred to the position of master mechanic at Jackson, Mich.

C. G. PLANT, SR., has been appointed road foreman of engines of the Southern, with headquarters at Spencer, N. C., succeeding J. M. Sink who has been granted a leave of absence.

G. B. REID has been appointed assistant master mechanic of the New York Central with headquarters at Detroit, Mich.

A. J. HARTMAN, master mechanic of the Atchison, Topeka & Santa Fe, at Albuquerque, N. M., has been appointed mechanical superintendent, with headquarters at Amarillo, Tex.

W. R. HARRISON, mechanical superintendent of the Atchison, Topeka & Santa Fe at Amarillo, Tex., has retired after more than 45 years of service.

W. S. WHITFORD, master mechanic of the Chicago & North Western, with headquarters at Boone, Iowa, has retired after 50 years of raliroad service.

JOHN FERTIG has been appointed master mechanic of the Atchison, Topeka & Santa Fe, with headquarters at Slaton, Tex.

H. E. ANDERSON, master mechanic of the Atchison, Topeka & Santa Fe at Slaton, Tex., has been transferred to the position of master mechanic at Albuquerque, N. M.

Shop and Equipment

T. W. BELLHOUSE, assistant general locomotive foreman of the St. Louis Southwestern at Tyler, Tex., has been appointed general locomotive foreman at Tyler.

W. H. LONGWELL has been appointed superintendent of shops of the Baltimore & Ohio at Cumberland, Md. Mr. Longwell was previously master mechanic at Grafton, W. Va.

Obituary

EVAN F. JONES, who retired in 1939 as master mechanic of the Chicago & Western Indiana, died at his home in Chicago on October 26.

L. P. MICHAEL, who retired on April 21, 1944, as chief mechanical engineer of the Chicago & North Western, died at Phoenix, Ariz., on December 18.